



ENCYCLOPEDIA AMERICANA



Arctic Ocean

East Siberian Sea

Beaufort Sea

Ellesmere Island

GREENLAND

Baffin Bay

Devon I.

Baffin I.

Hudson Bay

Davis Strait

USSR (SIBERIA)

Bering Sea

Wrangel I.

Point Barrow

Nome

ALASKA

Anchorage

Juneau

Kamchatka Peninsula

Aleutian Is.

CANADA

Vancouver

Seattle

Winnipeg

UNITED STATES

San Francisco

Los Angeles

Denver

Chicago

Detroit

Montreal

Ottawa

Toronto

Cleveland

New York

Philadelphia

Washington

Quebec

St. John's

Azores

North Pacific

North Atlantic

Ocean

Wake I.

Midway Is.

HAWAII

Honolulu

Marshall Islands

Gilbert Islands

EQUATOR

Bismarck Arch.

Solomon Islands

New Hebrides

New Caledonia

Tasman Sea

Auckland

Wellington

NEW ZEALAND

Marquesas Is.

South Pacific Ocean



Houston

New Orleans

Miami

Bahamas

Cuba

DOM. REP.

Puerto Rico

Virgin Is.

Caribbean Sea

GUATEMALA

EL SALVADOR

NICARAGUA

COSTA RICA

PANAMA

COLOMBIA

ECUADOR

VENEZUELA

TRINIDAD-TOBAGO

BR. GUIANA

FR. GUIANA

Suriname

Belém

Recife

Brasília

Rio de Janeiro

São Paulo

Asunción

Montevideo

Buenos Aires

Uruguay

Argentina

Chile

Peru

Bolivia

La Paz

Sucre

Santiago

Lima

Galapagos Is.

Cliperton

Mexico City

Havana

BR. HON.

ONDURAS

JAMAICA

Antarctic Peninsula

Antarctica

Marie Byrd Land

Victoria Land

Ross Sea

Bellingshausen Sea

Weddell Sea

S. Georgia

S. Shetland Is.

S. Orkney Is.

Tierra del Fuego

Falkland Is.

Argentine Islands

British Antarctic Territory

French Antarctic Territory

Chilean Antarctic Territory

Peruvian Antarctic Territory

Bolivian Antarctic Territory

Paraguayan Antarctic Territory

Uruguayan Antarctic Territory

Argentine Islands

British Antarctic Territory

French Antarctic Territory

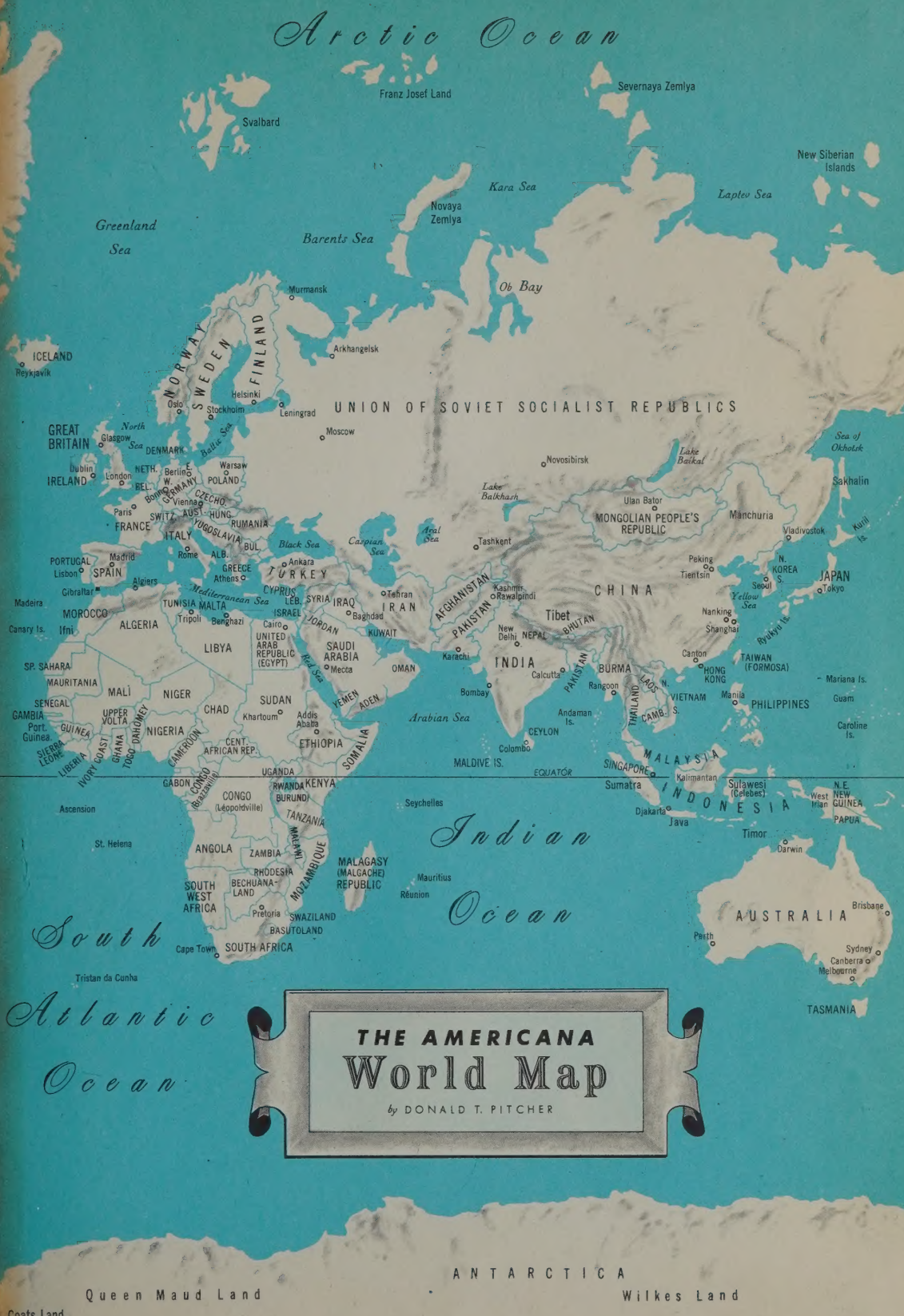
Chilean Antarctic Territory

Peruvian Antarctic Territory

Bolivian Antarctic Territory

Paraguayan Antarctic Territory

Uruguayan Antarctic Territory



Arctic Ocean

Franz Josef Land

Severnaya Zemlya

Svalbard

New Siberian Islands

Kara Sea

Laptev Sea

Greenland Sea

Barents Sea

Novaya Zemlya

Ob Bay

Murmansk

Arkhangelsk

NORWAY
SWEDEN
FINLAND

UNION OF SOVIET SOCIALIST REPUBLICS

ICELAND
Reykjavik

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DENMARK

NETHERLANDS

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POLAND

HUNGARY

ROMANIA

BULGARIA

GREECE

ALBANIA

YUGOSLAVIA

TURKEY

IRAQ

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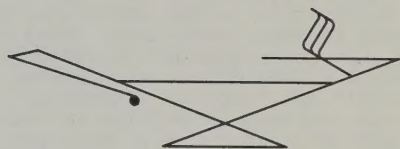
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VOLUME 15

India to Jeffers



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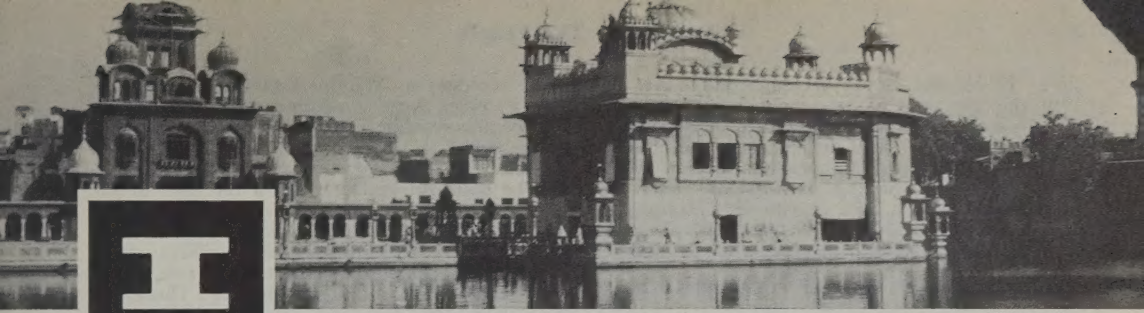
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INDIA: The Golden Temple, chief shrine of the Sikh religion, at Amritsar.

INDIA, in'di-ā, a republic of southern Asia. It is one of the two nation states which came into existence on Aug. 15, 1947, when the British Indian Empire was simultaneously given independence and partitioned into India and Pakistan. The seat of government is at Delhi, which has a population (1961 census) of 2,344,051. Including the protected state of Sikkim, the area claimed by the Republic of India is 1,264,012 square miles (the status of some of this area is disputed by Pakistan), and its population totaled 439,233,904 at the 1961 census. The national anthem is the *Jana-gana-mana*, with words by Rabindranath Tagore. The national flag has three horizontal stripes of equal width, the top saffron, the middle white, and the bottom dark green. In the center of the white stripe is Asoka's wheel. The coat of arms, derived from a pillar erected by Asoka at Sarnath, also shows the wheel.



Coat of Arms of India

Until 1947 the entire region now constituting the republics of India and Pakistan was known by the single term "India." This was in accordance with long practice. The ancient Greeks called the region *India*, meaning "the land of the Indoi," that is, of the people living near the River Indos (Latin, Indus). The basic Greek form *Indos* was an adaptation of an Old Persian and Avestan word, *hindu*, applied to the province of the Achaemenid Empire adjacent to the Indus River and meaning "land of the [great] river." The Old Persian in its turn was cognate with the Sanskrit word *sindhu*, "river," especially "the river [the Indus]." The Greek adjective to indicate something pertaining to the region was *Indikos*, "Indic," equivalent to the commoner English adjective "Indian."

The partition of the region brought the use of these terms into question. Since "Pakistan" and "India" referred to two political units, the old term "India" acquired a double usage. It applied in a wide sense to the whole geographic area and in a narrow sense to the recently demarcated nation. Many persons, especially those living in Pakistan, objected to the wider usage. A similar problem arose in connection with the phrases "subcontinent of India" and "Indian subcontinent" as applied to the wider area, and a certain vogue came to be attached to the designation "Indo-Pakistan subcontinent." In place of this awkward compound there is also used the appellation "South Asia," which generally has an inclusive application to India, Pakistan and Ceylon (with Nepal, Bhutan, and frequently also Afghanistan). Most writers on nearly all aspects of the subcontinent's life who are concerned with the period up to 1947 tend to retain the old and established forms "India" and "Indian," while commentators on political affairs since that date sometimes use the newly coined "Indo-Pakistan."

The people, land, economy, culture, and history of India are discussed under the headings listed below. With the exception of those dealing with the dance, music, and drama, linguistic science, languages, literature, science, religion and philosophy, prehistory, and history, in which the subcontinent is treated as a whole down to the time of its partition, the headings refer to the Republic of India. (For developments in the other major part of the subcontinent, see PAKISTAN.)

- | | |
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| 1. Political Divisions | 10. Linguistic Science |
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| 4. Economic Development | 13. Religion and Philosophy |
| 5. Way of Living | 14. Law |
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| 7. Architecture and Art | 16. Prehistory |
| 8. Dance, Music, and Drama | 17. History: 6th Century B.C.-1707 |
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1. POLITICAL DIVISIONS

The Republic of India's constituent political units are the distillate of a complex process of integration which followed the arrival of independence in 1947. At that time, the portion of the subcontinent included in the newly formed Union of India was composed of all or part of 9 former governor's provinces and 5 former commissioner's provinces of British India, plus more than 500 states ruled by native princes under treaty with the British. In the following decade the various provinces and states were gradually consolidated and refashioned to make them as nearly equal in status and linguistically homogeneous as pos-

sible. Under the States Reorganization Act of 1956 the territory of the republic was divided into 14 states, 7 territories, and a protected state. In 1960, Bombay was divided into the 2 new states of Gujarat and Maharashtra, and in 1961–1962 former Portuguese possessions were incorporated in India as 2 territories: Dadra and Nagar Haveli; and Goa, Daman, and Diu. A 16th state, Nagaland, is in process of formation.

AREA AND POPULATION OF THE STATES AND TERRITORIES OF INDIA

Component	Area (square miles) ¹	Population (1961)	Capital
<i>States</i>			
Andhra Pradesh	106,052	35,983,447	Hyderabad
Assam ²	84,899	12,578,530	Shillong
Bihar	67,189	46,455,610	Patna
Gujarat	72,138	20,633,350	Ahmadabad ³
Jammu and Kashmir ⁴	86,024	3,560,976	Srinagar
Kerala	15,003	16,903,715	Trivandrum
Madhya Pradesh	171,210	32,372,408	Bhopal
Madras	50,132	33,686,953	Madras
Maharashtra	118,530	39,553,718	Bombay
Mysore	74,122	23,586,772	Bangalore
Orissa	60,162	17,548,846	Bhubaneswar
Punjab	47,084	20,306,812	Chandigarh
Rajasthan	132,150	20,155,602	Jaipur
Uttar Pradesh	113,452	73,746,401	Lucknow
West Bengal	33,928	34,926,279	Calcutta
<i>Territories</i>			
Andaman and Nicobar Islands	3,215	63,548	Port Blair
Dadra and Nagar Haveli	160	57,932 ⁵	Dadra
Delhi	573	2,658,612 ⁶	Delhi
Goa, Daman, and Diu	1,505	625,831 ⁶	Goa
Himachal Pradesh	10,879	1,351,144	Simla
Laccadive, Minicoy, and Amindivi Islands	11	24,108	Kozhikode
Manipur	8,628	780,037	Imphal
Pondicherry ⁷	186	369,079	Pondicherry
Tripura	4,036	1,142,005	Agartala
<i>Protected State</i>			
Sikkim	2,744	162,189	Gangtok
Total	1,264,012	439,233,904	

¹ Revised in January 1961 pending final surveys of boundaries by the Survey of India. ² Includes North-East Frontier Agency and Nagaland. ³ Temporary. ⁴ Status in dispute with Pakistan; area for entire state, population for Indian-held area. ⁵ 1962. ⁶ 1960. ⁷ Includes Pondicherry, Karikal, Yanam, and Mahé, formally ceded by France in 1956 (cession completed in 1962).

The 15 principal states enjoy equal constitutional position in the federation, and each has its own bicameral or unicameral legislature. The official languages of each of the states are as follows: Andhra Pradesh, Telugu; Assam, Assamese; Bihar, Hindi; Gujarat, Gujarati; Jammu and Kashmir, Kashmiri; Kerala, Malayalam; Madhya Pradesh, Hindi; Madras, Tamil; Maharashtra, Marathi; Mysore, Kannada; Orissa, Oriya; Punjab, Panjabi; Rajasthan, Hindi; Uttar Pradesh, Hindi; and West Bengal, Bengali. Less completely integrated into the political structure are the territories: Himachal Pradesh, in the Punjab Himalayan area; Manipur, on the Assam-Burma border; Tripura, an enclave jutting out of Assam and almost entirely surrounded by East Pakistan; Delhi, which includes Delhi, the nation's capital, and its immediate hinterland; the Andaman and Nicobar Islands; the Laccadive, Minicoy, and Amindivi Islands; Pondicherry (Pondichéry), which includes Karikal, Yanam (Yanaon), and Mahé, former French possessions; and Dadra and Nagar Haveli (Nagar Aveli), and Goa, Daman (Damão), and Diu, former Portu-

guese possessions. Within Assam are the North-East Frontier Agency, administered by the president of the republic acting through the governor of the state; and the State of Nagaland, created in 1962. Sikkim is a protected state.

The basic political unit below the level of the state is the district, the primary building block of the Indian polity. It is at this level that all local administration is coordinated in the offices of the district collector and the district magistrate, which are frequently held by one person. There are wide variations, but most states have 15 to 20 districts, each of about 3,000 to 5,000 square miles and 1 million to 2 million inhabitants. A number of districts may be loosely grouped into a division headed by a commissioner, and below the district level there are usually from three to five subdivisions. Each subdivision is in turn divided into units called taluks or tehsils (tahsils), depending upon the part of the country, and finally into villages and towns or cities. The largest cities (with 1961 census populations for greater cities) are Calcutta (5,550,195), Bombay (4,152,056), Delhi (old and new cities, 2,359,408), Madras (1,729,141), Hyderabad (1,251,119), Bangalore (1,206,961), Ahmadabad (1,206,001), Kanpur (971,062), Poona (737,426), Nagpur (690,302), Lucknow (655,673), Howrah (512,598), Agra (508,680), and Varanasi (Banaras, 489,864).

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2. THE PEOPLE

Prehistoric Cultures.—The earliest human skeletal remains of the Indian subcontinent discovered in sites which can be confidently dated belong to the Harappa civilization, which flourished in the 3d and 2d millennia B.C. There is, however, archaeological evidence to show that man of a type or types unknown inhabited the subcontinent from the beginning of the Middle Pleistocene period. Various sites have yielded tools which afford a picture (though still obscure in many respects) of the Indian Stone Age. Two distinct manufacturing traditions are known for the Paleolithic period (Old Stone Age). One of them, with its main focus in the Potwar region of what is now West Pakistan, is called the Sohan (Soan) industry; its characteristic implements are pebble choppers, chopping tools, and flake implements. The second, known chiefly from sites in peninsular India, particularly in the vicinity of Madras but also in the Potwar region, is termed the Madras industry; this produced a different type of implement which was formed from the core of a pebble and not from flakes detached from the core. The archaeologist Hallam L. Movius, Jr., has expressed the view that the first has definite affinities with a culture known in northern China, upper Burma, and Java, while the other belongs to a great complex occurring in the Middle East, Europe, and Africa.

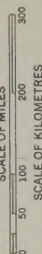
Succeeding phases of the Stone Age in the subcontinent are not fully known. Microlithic industries, perhaps introduced by a new ethnic element from the West, are widespread and have a long history, but they cannot be satisfactorily dated. Moreover, while polished stone implements such as characterize a Neolithic stage elsewhere have been found in large numbers, the existence of a true Neolithic stage—one in which agriculture and pottery making but not metallurgy were practiced—has not been definitely established.

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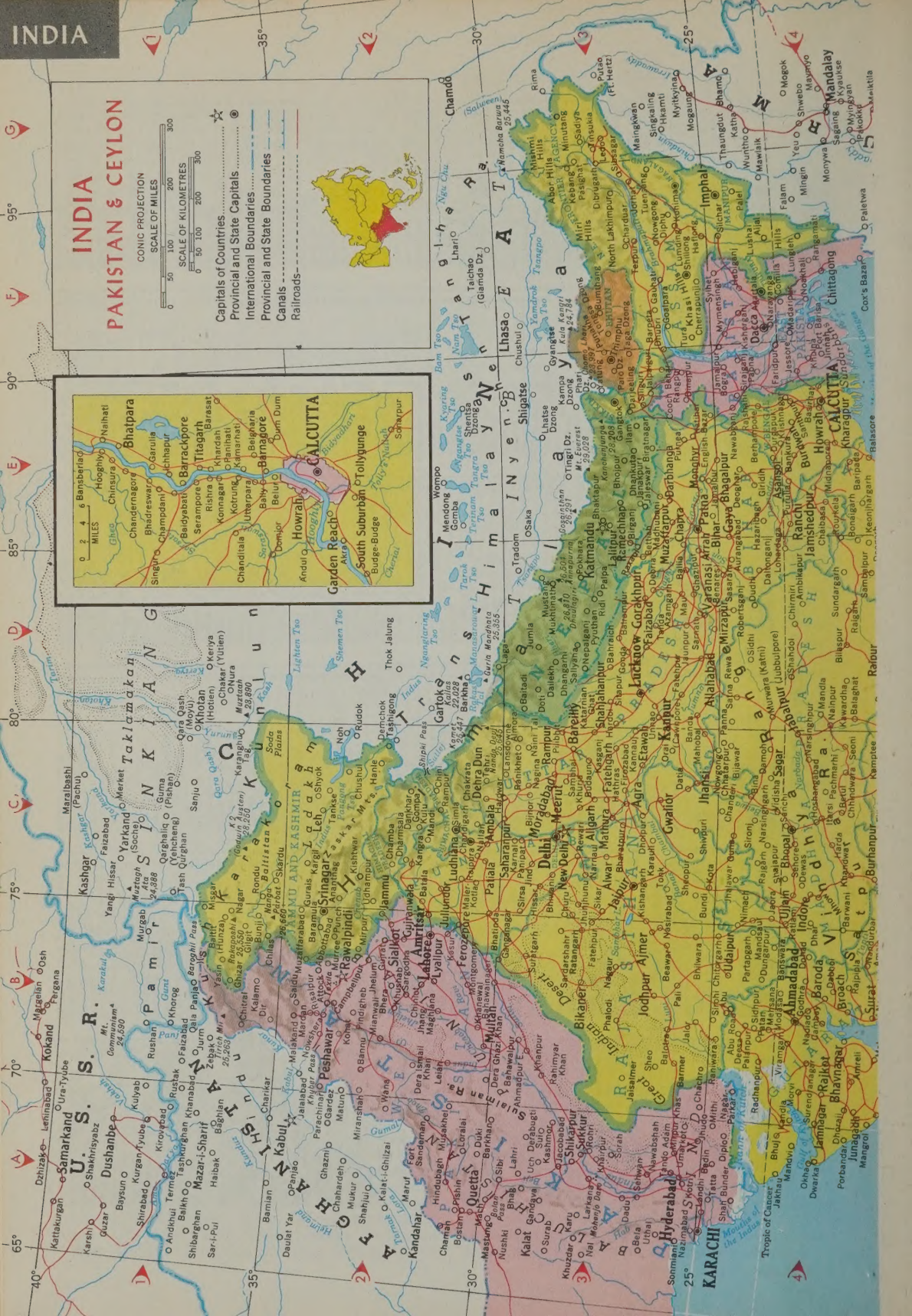
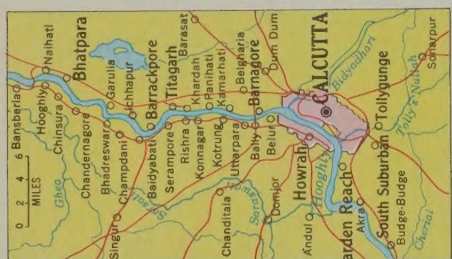
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PAKISTAN & CEYLON

CONIC PROJECTION



Capitals of Countries.....
 Provincial and State Capitals.....
 International Boundaries.....
 Provincial and State Boundaries.....
 Canals.....
 Railroads.....





INDIA, PAKISTAN and CEYLON (Continued)

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Racial Composition of the Modern Population.—The people of India are not physically homogeneous. Biraja Sankar Guha, in *Racial Elements in the Population* (London 1945), distinguishes six major racial strains which have amalgamated in varying degrees to form the modern population. One of these, termed the Mediterranean because of its prominence in that area, is characterized generally by a long head, moderate stature, a slight build, and dark skin. What appears to be an ancient type of this Mediterranean strain, in which the head is long and narrow with a high cranial vault, the face narrow, the nose small and moderately broad, the skin dark, and the hair wavy or curly, is the dominant physical type among the Dravidian-speaking peoples of south India. The evidence is as yet insufficient to determine when this type first entered India, but it is thought to have preceded the second and somewhat different Mediterranean type which formed an important element in the population of the Indus Valley during the period of the Harappa civilization, and which is prominent in north India today as well as among the upper castes throughout the country. As compared with the first type, this second type is taller and often lighter skinned; the nose is prominent, narrower, and less fleshy; the cranial vault is lower; and the growth of hair on face and body is more luxuriant. In the Punjab, Rajasthan, and western Uttar Pradesh in north India, and occasionally in the rest of the country, a third Mediterranean type may be discerned. It differs from the second chiefly in that the nose is unusually long and convex, and the skin is lighter.

The second of the main racial elements is a broad-headed strain which shows some affinities with the groups of brachycephalic peoples to the west—the Alpines, Dinarics, and Armenoids. In general, this type varies in stature from short to medium, and in skin color from light to dark brown; the head is broad and sometimes high; the nose is prominent and in some cases convex; and the hair is straight and usually abundant on face and body. One group of broad-headed people, perhaps allied to brachycephalic peoples in southern Arabia, appears on the west coast in Gujarat and Maharashtra, in the Kannada-speaking areas of Mysore, and in the Tamil-speaking areas of Madras. Another, somewhat different type may be observed in Bengal, Orissa, Mysore, and Madras. A third variant of this type, the Parsis in Bombay State, appears to be related to the Syrians and Armenians.

It is a reasonable assumption that both the Mediterranean and the broad-headed strains may be traced to groups of people who originally entered the subcontinent from the west, and the same is true of a third major element in the population. Like the Mediterranean strain, this type is dolichocephalic (long headed), but the head is larger. A tall stature, a long face, a straight and narrow nose, and light skin are other distinguishing characteristics. The dolichocephalic type occurs among the upper castes in northern India and here and there in western India, usually mixed to some degree with other strains. The term "Nordic," which is given to this type, indicates its broad affiliations.

The fourth main strain, a Mongoloid element in which the head varies from long to medium and the skin from light to dark brown, predominates along the northern borders of India and

among the tribal peoples of Assam. Typically, the stature is medium; hair is scanty on face and body; the face is short with prominent cheekbones; and the eye sockets are slanting, although the epicanthic fold, which gives a characteristic slitlike appearance to the eye, is not marked and occurs less frequently than among other Mongoloid peoples.

Two other major strains have been identified. One of these, thought to represent the earliest inhabitants of India, is the Negrito. The primitive peoples of the Andaman Islands belong to this group, but only a few slight traces remain in the population of the mainland. A stature of less than five feet and frizzly hair are the chief distinguishing features of this racial group, and individuals with frizzly hair are found today among some of the peoples inhabiting the hills of Kerala. The fact that hair of this type also occurs sporadically among other aboriginal peoples in India suggests that Negritos were at one time widely spread in the subcontinent. The second strain, which predominates among the tribal peoples of central, western, and southern India, and which is an important element in the lowest social strata of the population, is characterized by a long head; short stature; a broad, short face with strongly marked brow ridges; a small, flat nose; wavy to curly hair; and dark to black skin. Because of certain resemblances between people of this type and the Australian aborigines, it has been termed proto-Australoid.

Analysis in these terms makes it clear that the modern Indian population is a composite one, that considerable local variation exists, and that the upper classes are to some extent different in physical type from the lower social strata. The classification of the Indian population as a whole presents a problem for the solution of which adequate data do not as yet exist. Using an approach to the problem of classification based on blood grouping, the biochemists William C. and Lyle G. Boyd point out in the *American Journal of Physical Anthropology* (vol. 12, no. 3, pp. 393-405, Philadelphia 1954) that while there are serological resemblances between the peoples of India and Pakistan and Europeans, the differences (particularly the high frequency of the B blood group in the Indian and Pakistani population as compared with the European) appear to be too great to warrant the classification of Indians and Pakistanis with Europeans as a single racial group. Indians and Pakistanis share some similarities with the Asiatic race, as defined by blood grouping, but are nevertheless to be distinguished from it. The Boyds suggest that the peoples of India and Pakistan be classified as a separate racial group to which they give the name Indian or Indo-Dravidian, "to be regarded as intermediate between the Asiatic race and the European race, but closer to the European." Such a classification is not at variance with the evidence derived from a study of physical characteristics. On the basis of blood grouping, however, there is not much evidence to show a relationship with the Australian aborigines.

Tribal Peoples.—The tribal peoples of India have not been enumerated as a separate group since India and Pakistan were divided in 1947. Estimates of their numbers vary from 15 million to 26 million, in part because there are no clearly defined criteria for the enumeration of this group, and in part because in many areas it is almost impossible to draw a line between it and the low-

est castes of the Indian population. It is probable that some of the so-called untouchables were originally outside the Hindu social system, eventually came to be a part of it, and there held the place at the bottom of the social hierarchy which they now occupy. The process of assimilation is a continuing one. While they differ greatly from group to group, the tribal folk as a whole inhabit a more restricted world in a spatial as well as an interpersonal sense than other Indians, and their culture generally lacks the complexity and elaboration of the great Indian civilization.

Assam is the homeland of approximately 2.5 million tribal peoples who inhabit chiefly the hilly, forested regions of the state. Although a few tribes practice terraced agriculture, most of them still cultivate by cutting down and burning the jungle growth and sowing seed in the ashes. Every year or so they move on to a new patch of forest. (This method is practiced also by some of the tribal groups in central India.) The tribes of Assam speak a number of different languages, none of which were reduced to writing until Christian missionaries undertook the task in the 19th century. One large group, the Khasis, who speak a language of dubious external relationship, are organized in 25 small states, each with its own chief. Descent is in the female line, and women play important roles in social, economic, and religious life. A number of distinct tribes, the members of which speak Tibeto-Burmese languages and are known collectively as the Nagas, constitute about 97 per cent of the population in the Naga Hills. Formerly they were warlike, and the practice of head-hunting, chiefly for magical purposes, has not entirely died out. Although the Nagas differ not only in language, but in some respects in economic, social, and religious customs, they combined in the 1950's under a single leadership to demand autonomy, and in 1957 the autonomous Naga Hills-Tuensang Area was created within Assam.

Extending in a wide belt across central India are a number of other tribal peoples. The western end of the belt is the home of the largest single group, the Bhils. Some Bhils live in small, scattered communities more or less isolated in the hills, while others are attached as watchmen, menials, or agricultural laborers to villages occupied by members of the general Hindu population. All speak the language, or a dialectal variation of it, common to the area. Farther east, in Maharashtra and Madhya Pradesh, the Gonds, who speak a Dravidian language, form a bloc of about 3 million tribal peoples. Another Dravidian-speaking group, the Oraon, are found on the Chota Nagpur Plateau in Bihar along with a number of Munda-speaking tribes, the most important of which are the Santal, Ho, Munda, and Kharia. Other tribal peoples, some of them at least linguistically related to the speakers of Munda languages, extend throughout the hill country of Orissa. In the entire central belt the tribal peoples are concentrated in the hilly sections, while the more fertile and easily accessible plains are occupied by Hindu castes. Where the two groups have come into contact, the distinguishing features of tribal life tend to give way, and the tribal peoples gradually become assimilated; in the hills, cut off from extensive contact, the tribal peoples maintain a distinctive way of life.

This is also the pattern in south India. Here and there in the heavily forested hills of Kerala,

in Madras, and in Andhra Pradesh are small, scattered tribal groups who speak the language of the area but live a primitive life with an economy based on food gathering and the sale of forest products. The Chenchus of Andhra Pradesh, who number in all about 12,000, include a small group of several hundred who live a very primitive, seminomadic life in the hills of Amrabad. Their principal diet of wild tubers and fruits is supplemented in some cases by grain, which they cultivate in small patches; they have not adopted the plow, and their chief implements are the digging stick, ax, bow and arrow, and knife. Ceremonial life is simple in the extreme, and religious ritual is undeveloped. The Todas present another contrast to the typical south Indian way of life. Few in number, they are found in the Nilgiri Hills of Madras. In physical appearance and in dress they stand out from the surrounding population, and the architectural style of their temples and dwellings is distinctive and probably archaic. Their economic and religious activities, closely interwoven, center around their herds of buffalo. They are one of several matrilineal peoples in south India and practice polyandry.

See also 5. *Way of Living* and 16. *Prehistory*; and separate articles on ASIATIC TRIBES—India; BHILS; GONDS; KHASI; TODA.

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3. THE LAND AND ITS RESOURCES

Physiography and Geology.—Three major earth features exist in the Republic of India: (1) the stable massif of ancient crystalline rock which forms the Indian peninsula; (2) the northern mountain belt in which the rocks have been folded, faulted, and uplifted in the Himalayan system; and (3) the alluvial lowland of the Ganges and other Himalayan rivers, resulting from the filling of a great structural depression between the peninsular block and the extrapeninsular mountains.

Peninsular Massif.—The peninsular massif is a basement complex of Precambrian granite and associated Archean metamorphic rocks (gneiss and schist), which are estimated to be 500 million to 2,000 million years old. Wherever these formations outcrop, there are plateaus with undulating surfaces or hills with broad, rounded summits seldom rising more than 3,000 feet above sea level. Except along the coasts and in the largest interior valleys, the surface elevation is over 1,000 feet above sea level. Two high granitic masses are found in the south—the Nilgiri Hills, which rise to more than 8,500 feet; and the Anaimalai Hills, which reach over 8,800 feet. In the central, western, and eastern parts of the peninsular uplands the most prominent hilltops rise only 4,000 to 5,000 feet above the sea. The one portion of the Indian peninsula that can be described as a tableland is the Deccan, in the northwest, where many successive lava flows spread in the Tertiary period over an area measuring approximately 400 miles from east to west by 500 miles from north to south in Bombay State and Madhya Pradesh. Here the typical landscape features are the dissected remnants of the high lava beds, which form tabular ridges and terraces. The lava (also called traprock) is of basaltic composition and was emitted from fissures in the earth's crust without explosive eruptions, hence without the forma-



Above: Woman laborer in the Kumaun Himalaya of northern India carrying a sheaf of wheat.

Left: Young girl with a tumbura, one of the traditional musical instruments of India.

Right: In Kashmir, a Ladakhi weaves a coarse fabric on his rudimentary loom.



(Above) Kulwant Roy; (upper left) UNESCO; (upper right) Vidyavrata/FLO

INDIA

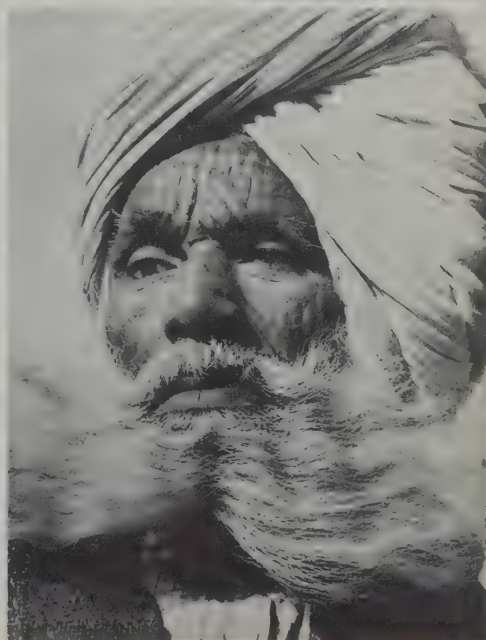
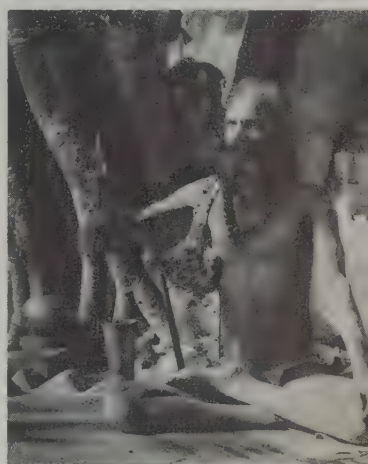
Left: Mother and child of a tribe called the Lambaras, living in south central India.

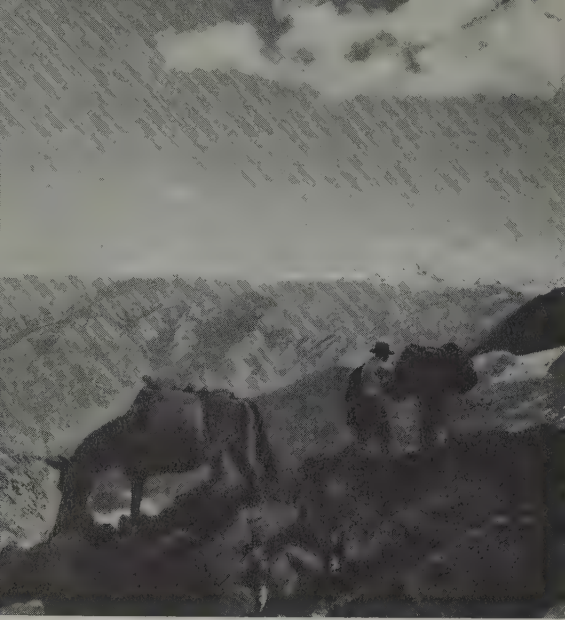
Right: Holy man seated under a banyan tree. His simple needs are provided by alms.

Below left: At an exhibition of the dance at New Delhi, a boy interprets the god Krishna.

Below right: The dignified face of an elderly leader of the Rajput community in Jaipur.

(Left and right) Vidyavrata/FLO; (below left) Kulwant Roy; (below right) Camera Press Ltd.—Pix





Werner Bischof from Magnum

The vast ranges of the Himalaya, seen from a high mountain pass on the border between Sikkim and Tibet.

tion of volcanic cones.

The configuration and drainage of the Indian peninsula have been influenced by vertical faulting and tilting of the massif. The part south of 21° north latitude has been tilted eastward and presents bold heights to the west along the line of faulting which determines the coast of the Arabian Sea. Three major rivers—the Godavari, the Krishna (Kistna), and the Kaveri (Cauvery)—start within 50 miles of the Arabian Sea and flow generally eastward for distances of 475 to 900 miles to the Bay of Bengal. The Arabian Sea margin of the peninsular uplands is an uninterrupted escarpment which forms a low mountain range known as the Western Ghats, a name derived from many passes (ghats) leading across the water divide and down to the coast. On the eastern side of the peninsula are several distinct ranges of hills or low mountains, collectively called the Eastern Ghats. These east coast highlands are interrupted by large breaks or deep water gaps through which pass the three major rivers as well as the Mahanadi and other rivers in Orissa. The east coast is bordered throughout by an alluvial plain, which is broadest where the deltas of the east-flowing rivers have been built. On the west coast below the main scarp of the Ghats, which is 30 to 50 miles inland, continuous alluvium is found north of Bombay Island and in Kerala.

The northern part of the peninsular massif is tilted northward, and its drainage is toward the Ganges River. The Vindhya Range of Madhya Pradesh is the dissected southern edge of this northern block. At its southern foot is a narrow east-west valley formed by downfaulting and drained through the Narmada River into the Gulf of Cambay and the Arabian Sea. The parallel Satpura Range to the south is a structural uplift, and the valley of the Tapi River is in part another downfaulted structure, also draining westward. The massif, which is capped with limestone and sandstone as well as with basaltic

lavas, ends in a ragged border along the margin of the Gangetic Plain and the Thar Desert of western Rajasthan. The northernmost part of the peninsular massif is formed by Lower Paleozoic and Precambrian sedimentary rocks (shales, limestones, and sandstones), folded and partly metamorphosed, worn by prolonged erosion, and appearing as ranges 2,000 to 3,000 feet in height known as the Aravallis, which trend from south-southwest to north-northeast in Rajasthan and terminate at Delhi in the Ridge. In the northeast the undulating surface of the massif known as the Chota Nagpur Plateau descends from southern Bihar to West Bengal and ends in the lava-capped Rajmahal Hills about 175 miles north of Calcutta.

Small outlying areas with structure and rock formations similar to those of the Indian massif are separated from it by alluvial veneer. To the west are the low-lying lava formations of the Kathiawar peninsula and the "island" of Kutch in northern Bombay State. Here and in the Thar Desert are found also the eroded remnants of various sedimentary rock formations, varying in age from the Upper Paleozoic to the Jurassic. To the northeast in Assam are the maturely dissected gneissic Garo, Khasi, and Jaintia Hills and the Mikir and Rengma Hills, separated from one another and the peninsular massif by alluvial plains and abutting the younger folded mountains of Tertiary rock formations along the Burma frontier.

Northern Mountains.—The great mountain wall which towers along the northern border of India is in almost every respect the antithesis of the peninsular massif. The rugged ridges and narrow V-shaped valleys of the Himalayan chains are features resulting from the rapid uplift of the rocks and the vigorous erosion processes prevailing here. The unusual height of the peaks in the Himalaya and Karakoram ranges results from the mountain-building forces that have been working here during the last great geologic era—the Cenozoic (Tertiary and Quaternary periods)—that is, during the last 60 million years. The folding and thrust faulting of sedimentary strata observed in the Himalayan mountain system indicate that horizontal compression has been exerted in the earth's crust, throwing up gigantic rock waves against the buried northern margins of the Precambrian massif. Fossils of marine origin found embedded in the rocks on the northern flanks of the highest range at elevations of 14,000 to 18,000 feet prove that these rocks were laid down in a sea existing in the Tertiary period over what is now the Tibetan plateau. The mountains are believed to be continuing to rise, the severe earthquakes of the region being symptoms of this active growth.

Both the rock structures and the surface configuration of the Himalaya show trend lines transverse to the direction of tectonic forces. The Great Himalaya, with some 40 peaks in India and Nepal between 25,000 and 29,000 feet above sea level culminating in Mount Everest (29,028 feet), forms a 1,500-mile arc from the Indus River on the west to the Brahmaputra on the east. The core of this range consists of granite and gneiss of unknown geologic age. The Lesser Himalaya, a parallel belt 50 to 80 miles wide which rises to heights of 7,000 to 15,000 feet above sea level, is formed by a series of recumbent folds overthrust from the north. This belt is composed of metamorphic rocks and unfossiliferous sedimentary rocks which are probably of the same origin as

the Precambrian and Paleozoic rocks of the peninsular massif, and which may actually represent the buckled edge of the massif itself. The foothill belt of the Siwalik Range, generally 2,000 to 3,500 feet above sea level and 10 to 15 miles in width, is developed in the youngest Miocene and Pliocene rocks involved in Himalayan orogeny and forms a distinct physiographic region of low, slightly folded ridges bordering the Indo-Gangetic plains.

To the north, paralleling the Great Himalaya, are ranges 20,000 to 25,000 feet high in Kashmir and Tibet. The Karakoram, lying 100 to 150 miles north of the western portion of the Himalaya, is the only range to equal the latter in height. Indeed, the crest of the earth waves in

this western portion of the extrapeninsular mountain system is found in the Karakoram, where the world's second highest peak, K², reaches 28,250 feet above sea level.

Flanking the Himalaya on the east is a succession of arcuate ridges turning southward from a hinge point in upper Assam along the frontiers of China to the Arakan Yoma in Burma. The structural trend of these simple folded mountains of Lower Tertiary and Cretaceous sedimentary rock formations is northeast and southwest in the rugged Patkai Range and Naga Hills (9,000 to 12,500 feet above sea level) and north to south in the Manipur Hills (rising to 8,400 feet above sea level) and the Lushai Hills (reaching over 5,500 feet).

The Republic of India: principal cities, products, and resources.



The rivers of the Himalaya tend to be entrenched in narrow valleys, some of which are cut directly between the highest peaks, and many of the sources of the largest rivers, such as the Sutlej, Indus, and Brahmaputra, are beyond the Great Himalaya in southern Tibet. Only north of the Indus in the Karakoram and south of the Brahmaputra in the Assam frontier ranges do the highest ranges of peaks form the water divides between these rivers and the rivers of interior or southeast Asia. A few intermontane basins exist within the extrapeninsular mountain belt in which Pleistocene lake-bed sediments form tracts of level land. The most prominent among them are the Vale of Kashmir, the Nepal Valley, and the Manipur Basin.

See also *HIMALAYA, THE*.

Alluvial Lowland.—The third great physiographic division is the lowland formed by the contiguous plains of the Ganges, Indus, and Brahmaputra rivers, development of which was contemporaneous with the building of the Himalaya. As the mountains were uplifted, the depressed belt to the south was gradually filled by detritus brought by the streams from the mountains, burying the hard rock under many thousands of feet of unconsolidated material. The Ganges (Gangā) and its Himalayan tributaries, the Jumna (Yamunā), Ghaghra (Gogra), and Gandak, flow southeastward obliquely to the main stream near the southern margin of the plain. Only the Kosi flows directly southward from the foot of the mountains in Nepal. The Ganges and Jumna receive relatively little flow or sediment from their southern tributaries, the Chambal, Betwa, and Son. The Punjab plain slopes generally southwestward from the foot of the Himalaya, and across it flow the five Indus tributaries, the Sutlej, Beas, Ravi, Chenab, and Jhelum, which enter Pakistan immediately upon leaving the mountains or shortly thereafter.

The stoneless surface of the plains appears to the eye to be perfectly flat, but local variations in relief and drainage introduce important modifications. Conspicuous eroded bluffs occur within a few miles of the major rivers in the southern half of the Gangetic Plain, indicating that alluvial material is being removed and redeposited downstream. All the rivers of the Indus and Ganges systems have become slightly incised below the surface in most parts of the plains and are capable of freely depositing fresh alluvium only in the fans, where they debouch from the mountains, and in the deltas near the coast. Most of the surface is therefore made up of natural terraces of old alluvium, not subject to flooding. The Brahmaputra in Assam is an immense braided stream, averaging a mile in width and much more in flood. The gradient is extremely low, and the river has a larger volume than either the Ganges or the Indus at high water.

The Thar Desert, which lies in Rajasthan adjacent to the plains of the Indus, can be considered part of the alluvial region, although the surface is broken by numerous rocky projections and by wind-drifted sand ridges. The desert is traversed by a prehistoric river channel, the Ghaggar, traceable 600 miles from the Punjab to Sind, by means of which the water from either or both the eastern Indus or the western Ganges affluents once reached the Rann of Kutch. Today the Rann is a sterile, salt-encrusted marsh, cut off from the sea and inundated briefly during the summer monsoon season.

Mineral Resources.—India is only moderately well endowed with coal, deficient in petroleum, but rich in certain metallic ores and mica. It is in the peninsular massif that most of the significant deposits are to be found.

Of the conservatively estimated reserve of 50 billion tons of coal, 98 per cent occurs in a series of fault basins containing beds of Lower Gondwana (Paleozoic) age. The most productive mines are in the Damodar Valley in the Chota Nagpur Plateau of southern Bihar and adjacent West Bengal. Other coalfields exist chiefly in the faulted belts of the Mahanadi and Godavari valleys, Madhya Pradesh, Orissa, Bombay State, and Andhra Pradesh. About 99 per cent of India's annual coal output of approximately 45 million tons is derived from the Lower Gondwana deposits of the peninsula. The balance is obtained from low-grade Tertiary formations located in the piedmont plains of northern Bengal and Assam. Much of Gondwana coal is of high-grade bituminous quality, and it is possible that there may be as much as 80 billion tons of all grades available, but relatively little is of coking quality.

There is petroleum in the Tertiary formations of upper Assam, but the small oilfields located here produce only about 5 per cent of the nation's annual consumption of 7 million to 8 million tons. Hence, India is dependent upon Burma, Indonesia, and the Persian Gulf countries for most of its petroleum requirements.

India's iron reserves are unquestionably among the richest in the world. Ore of highest quality occurs in large deposits capping the hills in the northeastern peninsular uplands. The hematite bodies of Orissa and Madhya Pradesh, which yield 60 to 65 per cent metallic iron, are estimated to contain at least 4 billion and possibly 8 billion tons of ore. There is also good hematite in Mysore and magnetite ore in Madras. The country produces between 5 million and 6 million tons of iron ore annually, and the iron and steel industry is developing rapidly.

Deposits of other metallic minerals and of mica are associated with the Precambrian and Archean crystalline rocks in three general areas: (1) the northeastern portion of the peninsular massif in southern Bihar, interior Orissa, central Madhya Pradesh, and easternmost Bombay, where the most important workings of manganese, copper, chromite, and mica are located; (2) the southern portion of the massif in Andhra Pradesh, Mysore, and Madras, where gold is most abundant, and where manganese, mica, magnesite, and chromite also are obtained; and (3) the northern portion of the massif in Madhya Pradesh and Rajasthan, where lead-zinc ore, mica, and manganese are worked. India ranks as a foremost source in world trade of mica and manganese but is unable to supply domestic requirements for copper, lead, and zinc.

The black beach sands of the southern coasts, particularly in Kerala, yield ilmenite, from which is obtained titanium, useful as a white pigment; and monazite, from which the heavy radioactive metals, thorium and uranium, are derived. India has great fame as a source of diamonds, and it does not appear that all the diamond deposits have been exhausted, although the annual output is small. The country is well endowed with bauxite, limestone, and industrial clays and sands, and has made a good beginning in the manufacture of aluminum, cement, and various ceramic products. Salt, amounting to 3 million tons annually,

is obtained from the evaporation of seawater along the peninsular coasts; from brine springs, wells, and salt lakes in arid or semiarid regions of Rajasthan and Uttar Pradesh; and from rock salt in the northern mountains.

See also *COAL*—4. *World Coal Resources* (Coalfields of Europe, Asia, and Africa); *IRON*—9. *World Supplies* (Asia).

Climate.—Three seasons are recognized in India: the rainy season, the cool season, and the hot season. The rainy season (June to October) is a time of high temperatures and abundant moisture, brought by the summer monsoon, upon which the agriculture and the very life of India's people largely depend. The cool season (November to February) is a time of the continental monsoon and prevailing dry weather except in the northernmost plains and the adjacent mountains and in the extreme southeast coast of the peninsula. The hot season (March to May) is also a time of the continental monsoon and of continued dry weather except in southern Kerala and Assam.

The arrival of the summer monsoon air causes dark clouds to gather and rain to begin abruptly. So distinct is the rise in humidity and the fall in temperature that the Indian Meteorological Department officially records the date of arrival at each of its observatories. But the arrival of the monsoon does not automatically bring water to the parched plains of India as though a garden sprayer had been turned on. The largest and most reliable precipitation is received on the windward sides of mountains. The western slopes of the Ghats are extremely rainy because they stand almost at right angles to the path of the tropical maritime air, coming directly west across the Arabian Sea. The Assam hills and the eastern Himalaya are also exposed fully where the recurring monsoon blows against their southern slopes. At least 75 inches of precipitation (June to October) are received throughout each of these mountainous areas. The most intense precipitation (100 to 200 inches) does not occur on the coast or at the foot of the mountains but at intermediate elevations, where the instability levels are reached in the ascending air at 2,000 and 3,000 feet in the Western Ghats and along the ranges east of 88° east longitude at levels between 3,000 and 5,000 feet. Cherrapunji, at an elevation of 4,300 feet in the Khasi Hills south of Shillong, Assam, is perfectly situated for the full orographic effect, receiving an average annual precipitation of 426 inches, one of the two highest recorded averages in the world (the other is 476 inches, in Waialeale, Hawaii).

Rainfall occurs in areas of low relief chiefly because the sun heats the ground each day, producing convectional updrafts, cumulus clouds, and light, scattered showers. A large share of the 30-to-60 inch precipitation (June–October) in the northern plains and in the interior valleys and hill country of central and northeastern peninsular India is of this simple convectional type. On the leeward, east-facing slopes of mountains and in the interior plateaus and valleys of peninsular India, precipitation is only 10 to 30 inches during the rainy season. The maritime air is no longer saturated because of the release of so much moisture on the windward slopes of the mountains and because of adiabatic heating, which occurs as the air descends the leeward slopes. Two dry rain shadows therefore exist within tropical India: (1) the large area behind the Ghats which occu-

pies the interior parts of Bombay and Andhra Pradesh, as well as much of Mysore; and (2) the region east of the Nilgiri and Anaimalai Hills in southern Madras.

North of 20° north latitude, however, rain shadows disappear because of the easterly lows which traverse central and northern India three or four times a month from June to September. These lows appear between 20° and 25° north latitude, where the southwest winds of the monsoon are recurving as southeast winds at the head of the Bay of Bengal. As a low migrates to the west, the precipitation gradually decreases because dry, continental air enters its vortex in increasing amounts, and the source of the moist air becomes progressively more distant. By the time the low has reached Rajasthan, continental air has become dominant, and precipitation is meager south and west of Delhi. This circulation pattern of maritime air currents in these lows accounts for the copious rainfall over the lowlands east of 78° east longitude and north of 20° north latitude, and also adds to the intensity of orographic rainfall in the eastern Himalaya.

Dry continental air masses gradually spread over northern India during September and October and dominate all of South Asia during the ensuing cool season from November to February. Reduced insolation during the Northern Hemisphere winter allows the land to cool, and atmospheric pressure rises slightly higher over the land than over the adjacent warm seas. The combination of cool, dry air at the surface and stable dry air aloft produces the cloudless, sunshiny weather prevailing at this season. The mean January temperature remains above 70° F. in southern India and above 60° F. in the interior lowlands as far north as Delhi. Beyond 28° north latitude the monthly mean for January falls to about 55° F., and light frosts occur on the plains, while in the Himalayan foothills the average January temperatures decrease to 32° F. at altitudes over 5,000 to 7,000 feet.

Not everywhere is the weather dry throughout the cool season. During October and the following two or three months the wet monsoon is recurving in the Bay of Bengal, bringing the year's heaviest rainfall to the rain-shadow areas east of the Ghats. Weak easterly lows continue to form in the retreating maritime air over the water and move toward the east-facing coasts. Occasionally violent tropical cyclones of the hurricane type appear drifting from the east or southeast over the Bay of Bengal or the Arabian Sea and affect the coasts of Bengal and peninsular India. The rainfall of the retreating monsoon is confined mostly to the east coast of India south of 15° north latitude, where November and December are the rainiest months of the year.

In extratropical India, November marks the beginning of a season of occasional rain, brought by the westerly lows or winter cyclonic storms of the middle latitude type, the so-called western disturbances. As frequently as four or five times a month (December to April) these cyclones cross the country, generally north of 30° north latitude. The frosts on the plains of extratropical India occur during the nights following the passage of westerly lows, when cold continental air from the plateaus of southwestern Asia has invaded the plains. In the high basins and mountain valleys minimum temperatures of 0° F. are experienced under clear night skies and the influence of local air drainage during the calms following the pas-

sage of the cyclones. The cool season precipitation, which amounts to less than 5 inches in the Punjab plain and to as much as 10 or more inches in the adjacent mountains, is derived from the maritime air brought inland by the lows. The high ranges of the western Himalaya and the Karakoram become blanketed under heavy snow and are believed to receive most of their annual precipitation at this season.

The northward shift of the sun's vertical noonday rays and the increasing length of the days during March, April, and May cause the belt of most intense solar radiation to move progressively northward over the tropical part of India and finally, by June, into the extratropical part. The temperatures therefore become progressively higher, and occur progressively farther north during the hot season. In March the highest daytime temperatures of about 100° F. are in the interior Deccan of Bombay, in April the highest daytime temperatures of 110° F. are in Madhya Pradesh and northern Bombay, and in May the highest daytime temperatures of 120° F. are in Rajasthan. Almost equally high temperatures are recorded in the northern interior plains of Uttar Pradesh and the Punjab in June before the arrival of the summer monsoon. The afternoon hours at this season become so intolerably hot that human activity ceases until sunset approaches. Both men and beasts seek shelter from the burning sunlight and look out upon the dry, brown earth, awaiting the arrival of the life-giving monsoon.

See also RAINFALL—*Distribution of the World's Rainfall*.

Vegetation.—The distribution of wild vegetation in India is manifestly related to climatic conditions, but because of the depredations of man there are few areas where "natural" vegetation exists, or where the unhampered growth of plant cover fully reflects climatic potentialities. A large fraction of the area not actually under cultivation or in fallow supports only a scanty growth of low scrub or thin grass because of frequent lopping of branches for firewood and continued browsing by livestock. Much mountain or hill land not under permanent cultivation has been repeatedly cleared by burning for shifting cultivation. The three most important forest zones are (1) the evergreen broadleaf, (2) the deciduous broadleaf, and (3) the thorn scrub. The distribution and composition of these forests is controlled chiefly by the supply of moisture. Temperature has a secondary influence except in the extrapeninsular mountains above an altitude of 3,000 or 4,000 feet, where the subtropical, temperate, and alpine forest zones exist.

In general, an annual rainfall of 80 inches is necessary to support the dense stand of large, soft-leaved trees which constitutes the evergreen broadleaf forest. While as little as 50 inches will support evergreen growth if the rains are well distributed throughout five or six months from May to October, as much as 200 inches are necessary under unfavorable conditions, such as steep slopes or dry soil. The fully developed tree canopy consists of a variety of species which retain their foliage throughout the year. The dominant species include several belonging to the family Dipterocarpaceae. The understory and shrub growth are scanty, but there are many lianas and epiphytes. Where the rainfall is less than 80 inches annually, certain deciduous broadleaf trees may be present in the top canopy, forming a semi-evergreen forest type which becomes progressively

more prevalent toward the dry margins of the zone. One part of the evergreen broadleaf zone is located along the western coastal lowland of India and on the rainy windward slopes of the Ghats. The largest area of this vegetation spreads from the hills of East Pakistan into the Assam lowlands and hills.

The deciduous broadleaf forest zone is located in the hills and plateaus of central and southern India, where annual rainfall of 35 to 80 inches occurs almost exclusively during the four or five rainy months from June to October. The deciduous character of the dominant tree species is a response to the long period of dry weather. The branches of the trees forming the top canopy gradually become bare as the soil dries and the hot season approaches. The understory is composed of small evergreen broad-leaved trees and bamboos in the moist deciduous type of forest, where the rainfall is 60 to 80 inches. Teak (*Tectona grandis*) and sal (*Shorea robusta*) are typical species of economic value in the moist deciduous forest areas of the uplands in peninsular India, where the natural growth is least disturbed by man. Dry deciduous forest is prevalent where the rainfall is as little as 35 or 40 inches. Even the understory trees become bare in the dry season. Shrubby undergrowth is often present, and sometimes there is grass, which tends to become more highly developed under burning and shifting cultivation. In places a parklike landscape may result, but no tropical savanna type of vegetation is widespread in India. The term "jungle," derived from the Hindi word *jāṅgal*, is commonly applied in India to these tropical deciduous forests and to the thickets into which they degenerate under the inroads of woodcutting, shifting cultivation, and grazing.

Thorn scrub is associated with the semiarid climatic areas of northwestern and peninsular India, where the annual precipitation is between 20 and 35 inches. The fully developed forest under this climate consists of an open canopy of thorny hardwood species, predominantly of the genus *Acacia*, which have short boles of 20 to 30 feet and low branching crowns which rarely meet. There is an ill-defined lower story of spiny xerophytic shrubs and sparse grass which does not completely cover the ground even during the rainy season. The thorn scrub forest is replaced by xerophytic shrubs and fleshy *Euphorbia* cactus where the trees are destroyed by woodcutters and livestock.

Soil Zones.—The varied characteristics of soils in the vast alluvial region of northern India depend primarily on the texture and fertility of the parent material. Yet on the terraces of old alluvium above flood levels in the warm and humid climatic zone there is evidence of leaching and laterization associated with the subtropical climate. Effects of soil formation on terraces in the dry climatic zone of northern India tend to produce profiles somewhat resembling the chestnut and brown steppe soils of middle latitudes. The most important effects of soil formation in alluvium under the arid and semiarid climates are the subsoil lime concentrations, due to leaching, and the salt encrustations, resulting from the evaporation of ground water in low spots. Some alluvial areas are covered with peat where drainage is impeded.

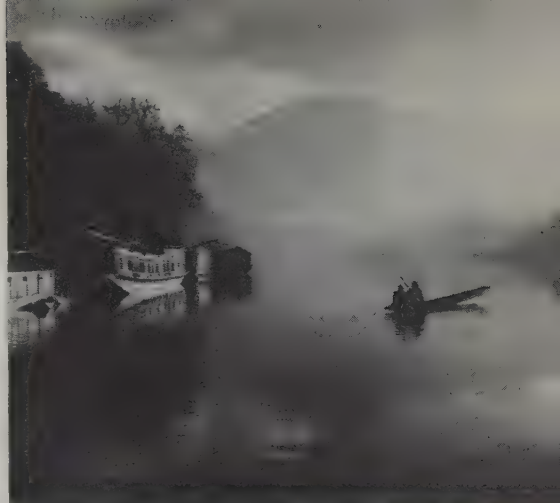
In the Indian peninsula well-developed zonal soils are spread over the undulating, rolling, or hilly terrain. Here the outstanding zonal soils belong in two groups: (1) dark-colored regur,

and (2) yellow or red lateritic soils and the true laterite of reddish brown color. The regur soils are spread over approximately 200,000 square miles of territory between 73° and 80° east longitude and 15° and 25° north latitude, mainly in Bombay and Madhya Pradesh. They also occur south of 15° north latitude in outlying areas in Mysore and southern Madras, and east of 80° east longitude in the northeastern peninsular uplands. Soils of this group are composed of dark brown or black clayey material which expands during the rainy season and contracts during the dry season. Regur soils are commonly found over parent material derived from the basaltic Deccan lavas or on alluvium from the same source, and their color has often been ascribed to the basic minerals present in the parent rock. But regur is also developed from bedrock of sedimentary origin, such as limestone, shale, and sandstone; from calcareous clays; and even from metamorphic slates and gneisses. Generally the rocks upon which all of these dark-colored soils are developed are basic in character and low in quartz (silica) content, and form slowly permeable clays upon weathering. The lime (calcium) content of the regur soils also is high. Although the dark color is now proved to be due to finely divided organic matter rather than to the color of the parent rock, the organic matter content (less than 1 per cent) is very low in comparison with the black chernozem and dark brown prairie soils of middle latitudes.

Wherever peninsular India receives more than 60 inches of annual precipitation, there are lateritic soils or laterites. The lateritic soils vary from the deep red clayey soils of the valleys to the light red and yellow gravelly or loamy soils of the hills and lower slopes. Indurated laterite crust is found on hilltops or mountains and on old alluvial or marine terraces. Lateritic soils are deficient in nitrogen, phosphorus, and humus and are generally low in potassium and lime, but are rich in hydrated aluminum and iron oxides. The red and yellow soils commonly contain more siliceous material than true laterite does. The latter forms evidently as the end product of the leaching out of siliceous material and of almost all other mineral compounds except the oxides of iron and aluminum. It becomes an inert, honey-combed mass of iron and aluminum clay through which water passes without causing much runoff or erosion.

Land Utilization.—The most significant features of land utilization in India are (1) the large fraction of the area suitable for agriculture, and (2) the extent to which the good land has been brought under cultivation. About 11 per cent of the surface area of the country is made up of mountains over 7,000 feet in elevation, almost all of which are too steep or too cold for agriculture. Another 18 per cent is hill land between 1,000 and 7,000 feet above sea level, three quarters of which are too steep to farm. Plateaus of relatively low relief between 1,000 and 3,000 feet form 28 per cent of all land in India, all but a quarter of which is topographically usable. In the lowlands of less than 1,000 feet in elevation, which comprise 43 per cent of the total area, only 1 acre in 20 is unusable because of roughness of topography. Altogether, 66 per cent of the land is topographically usable, but climate imposes limits of aridity which reduces cultivation to about 40 per cent of the total area.

The total cropped area is about 350 million



Kulwant Roy

A romantic view in the Vale of Kashmir.

acres. While this amounts to less than 1 acre per capita, it means that among the large nations of non-Soviet Asia, India is one of the best endowed with agricultural land. About 52 per cent of the village land area classified (77 per cent of the total area of India) is in crops or fallow. Wasteland and land devoted to urban or village settlement and other nonagricultural uses comprise 16 per cent of the area classified; forest land, 15 per cent. The remainder, 17 per cent, is made up of village pastures and firewood groves, jungle scrub and bamboo, private forests, and cultivable wasteland. Most of this land is submarginal, however, and cannot be brought under cultivation. The agricultural land may be divided into three major categories on the basis of the crops grown and the methods of farming: (1) wet cultivation, (2) dry cultivation, and (3) irrigated cultivation.

Wet cultivation prevails in the alluvial lowlands in tropical or subtropical latitudes with 40 inches or more precipitation in eastern and southern India. The leading crop is rice, which occupies one half to two thirds of the area planted annually except in the Gangetic Plain of Bihar and eastern Uttar Pradesh and on the coast of Kerala, where it accounts for about 40 per cent of the planted area. Winter wheat and barley (in the Gangetic Plain), corn, and various oilseeds are the commonest secondary food crops in the areas of wet cultivation, but rice is ideally suited to the naturally inundated plains wherever rainfall of 60 inches or more is received. Irrigation is necessary for rice in the eastern coastal deltas and interior lowlands, where the rainfall is less than 60 inches. Rice produces an average of 750 pounds of grain per acre in India, or more than any other grain, and it supports the densest rural population—600 to 1,000 or more persons per square mile. Sugarcane and jute are important as sources of cash income in the alluvial areas of northern and eastern India, and tobacco is a locally significant cash crop in Bombay and Andhra Pradesh. Coconuts are produced commercially on the coasts, especially in Kerala. Coffee in Madras, tea in Madras, northern Bengal, and Assam, and rubber in Kerala are commercial plantation crops produced on the red lateritic soils of the terraces and uplands adjacent

to the flood plains under wet cultivation.

Dry cultivation prevails in the uplands and interior valleys within the peninsular massif and along the margins of the Indo-Gangetic plains. The climate in general is semiarid with 18 to 35 inches of rain, but dry cultivation extends into the desert zone of Rajasthan, where rainfall is as little as 15 inches, and into central India, where as much as 40 inches are received. The fertile regur soils are widespread here, but water supply is insufficient to irrigate much land adequately. The necessity of following to conserve moisture in the subsoil withdraws one tenth to one third of the arable land from crop production each year. Rice production is unimportant, though not excluded, and wheat is important within the region of dry cultivation only in north central India. Sorghum and the lesser millets are the dominant subsistence crops, though poor substitutes nutritionally for rice and wheat. Grain sorghum, called jowar, durra, or *cholum* in India, is a major crop throughout the region of dry cultivation and is the food grain second in rank after rice in acreage and production in the country as a whole. Bulrush millet (*Pennisetum typhoides*), called bajra or cumbu in India, has somewhat lesser moisture requirements than sorghum and is concentrated in the drier parts of the Deccan and Rajasthan. Finger millet (*Eleusine corocana*), called ragi (raggee) or *marua*, and another millet called *kodo* (*Paspalum scrobiculatum*) are the most tolerant of drought. Altogether, there are nearly three dozen species of lesser millets which will grow under conditions where wheat or rice would fail. Oilseeds, particularly peanuts, sesame, and castor seeds, are produced under dry cultivation. Cotton growing is widespread and is the chief source of cash income. Cotton acreage is concentrated on the black regur soils of the northern Deccan, but the yield and quality are not as high as on the northern Bombay coast. In general, agricultural production is less intensive under dry cultivation than under wet cultivation, and the population density averages about 200 to 400 persons per square mile or less.

Irrigated cultivation is the basis of agriculture in an extensive belt in the semiarid plains of Rajasthan and the Punjab and in the upper Gangetic Plain in Uttar Pradesh. Irrigation is practical because of the abundance of water from the melting winter snows and the heavy monsoon rains in the Himalaya. Much water is brought to the alluvial terraces through modern systems of diversion dams, canals, and ditches. The ground water table is close to the surface and is tapped by means of hand-dug wells or tube wells in order to irrigate fields not reached by canals. Flood-plain irrigation is commonly accomplished from wells or seasonal inundation canals. These irrigated plains of northern India support a moderately dense rural population, ranging from 100 to 600 persons per square mile, and form the most prosperous agricultural areas.

In the northern irrigated tracts winter wheat is the most widespread subsistence and cash crop. Barley is a second winter grain, grown for subsistence. Maize, sorghum, and bulrush millet are the most important subsistence crops produced in summer, often not in irrigated fields because the water must be conserved for cash crops. Cotton of better quality than that of peninsular India is grown, and commercial sugarcane has gained in importance. Oilseeds, especially linseed and rape-

seed, are locally significant. Legumes and fodder crops are relatively more important than anywhere else in India.

Irrigated cultivation also is widespread in peninsular India. It is intensively developed along the east coast in Madras and Andhra Pradesh, where one third of the area under crops is watered artificially in some manner. Diversion dams and elaborate canal systems ensure the crops in the rich deltas of the Kaveri, Krishna, and Godavari rivers. Elsewhere in the alluvial lowlands and in upland valleys of the Deccan innumerable storage reservoirs have been created by excavation or building with dams. Water reaches the fields by means of primitive lifting devices, by ditches, and by seepage underground. The crops grown are rice, where the water supply is abundant, and the typical dry crops of the region elsewhere.

In the country as a whole an area of almost 58 million acres, or 16 per cent of the total cropped area, was under irrigation in 1956, and planned development called for the addition of 20 million acres. The increase of irrigation was expected to help alleviate the two greatest problems of agricultural land utilization: (1) the high percentage of cropland fallowed each year (about 1 in 5 acres), and (2) the generally low crop yields.

Another Indian agricultural problem is that of animal husbandry. According to the livestock census of 1956, the country has 203.6 million cattle, including water buffaloes, and 94.6 million sheep and goats. In addition, there are horses, donkeys, camels, pigs, and poultry, resulting in a farm-animal density too great for proper feeding. The cows give meager quantities of milk, and because of religious taboos little beef is used.

See also 4. *Economic Development*; and separate articles on CATTLE; COTTON; DAMS—*Dams in Foreign Countries* (India); HYDRAULIC ENGINEERING—*Multipurpose River Basin Development*; JUTE; MILLET; RICE; TEA.

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4. ECONOMIC DEVELOPMENT

INDIA BEFORE 1947

Rural Economy.—The development of the rural economy of India before independence may be divided into three periods: that of pre-British society (to 1793), the period in which new land systems were introduced (1793–1850), and that of the spread of commercial agriculture (1850–1947).

Pre-British Structure of Indian Society (to 1793).—The outstanding feature of the economy of India before the advent of British power was the self-subsisting and self-perpetuating character of its typical unit, the village. India's villages functioned as little worlds of their own. The only outside authority which they acknowledged was that of some local princeling who in turn might be subordinate to a distant overlord. The chief sign of submission to that authority was the payment of a share of the village crops.

Within the village social and economic relationships were governed by customary patterns and conventions of great antiquity. The cattle were tended and the soil was tilled by peasants whose fathers had been cultivators and whose sons would take their places when they came of age. Cloth for the garments of the peasants generally was spun and woven by families whose ancestors

had been weavers long beyond the living memory of man. The other crafts were carried on by families which in effect were servants of the village. Their occupations passed on traditionally from father to son: the blacksmith, potter, and carpenter, who made and repaired the implements and utensils of the village; the silversmith, who made the village jewelry; and the oilseed presser. For their services these craftsmen received a regular stipend from the crops of the villagers. In some areas hereditary servants and slaves attached to peasant households performed both domestic and agricultural duties.

The village itself consumed most of the raw materials it produced. Its needs for handicrafts were satisfied by the craftsmen associated with the village. It was this tight union of agriculture and hand industry which made the village independent of the outside world except for a few necessities like salt and iron. The share of the crops which went to the local magnate and moved on from him in a diminishing stream upward to the highest political overlord sustained the structure of government and provided subsistence for the urban population. As the local chiefs often constituted a rallying point against the center, some emperors and kings tried to weaken their power by collecting the land revenue without their participation. In their stead they created tax farmers or operated through subordinate revenue officials.

With the exception of pilgrimage centers, India's towns and cities generally were little more than headquarters for the top political overlords or imperial courts. The industries which were carried on in these cities were of two classes: those which met the minimum wants of the urban population, and those which provided mainly luxury goods for the upper classes or implements of war for the army. Economically, the cities had a one-way relation with the countryside, taking foodstuffs as tribute but supplying virtually no goods in return.

This was the structure of Indian society which the British found between 1750 and 1850 as they conquered one part of India after another. The basic land relationships were rooted in custom and usage rather than in statutes, legal cases, and court procedures. So long as the peasants turned over to the local potentate his customary tribute and rendered him the usual services, their right to till the soil and reap its fruits was taken for granted. Local rulers who repeatedly abused this right were considered oppressive; if they persisted, the peasants fled to areas where the customs of the land were better respected. As land was still available for settlement and labor was not too cheap, local chiefs had to be careful lest they alienate the villagers.

The British conquest of India through the agency of the East India Company led to the most drastic changes in the Indian way of life of which we have record. The most fundamental of these changes was the disintegration of the older structure of the village community, partly as a result of new land systems, and partly as a result of the spread of commercial agriculture.

Introduction of New Land Systems (1793-1850).—In making arrangements for collecting land revenue in the areas of India which they conquered, the British were primarily concerned with securing the largest possible amount. For it was basically from these sums that British conquest and consolidation were financed. Two

major types of land revenue systems were devised. In Bengal and adjacent areas, beginning in 1793, the British converted the tax farmers and revenue collectors into private landlords, granting them some of the rights of private property in the land. This was done on condition that the new landlords would raise greatly enhanced revenues from the cultivating peasants and pass the bulk of these revenues on to the state. This land revenue system is known as the zamindari system (Hindi *zamindārī*, from *zamindar*, *zamindār*, or landholder).

An entirely different system was devised for large parts of Bombay and Madras and later applied to areas in the northeast and northwest. Here the British dealt directly with the individual peasants, for thereby they hoped to be able to obtain more revenue than under the zamindari system. Each peasant was recognized as holding the particular plot or plots he occupied, but his right to the land depended on annual payment in full of a heavy money rent to the government. Because it dealt directly with the peasant or ryot (Hindi *ra'iyat*), the new system was called the ryotwari (Hindi *ra'iyatwārī*) settlement. Whereas the zamindari system made the landlords masters of the village communities, the ryotwari system cut through the heart of the village communities by making separate arrangements between each peasant cultivator and the government.

These two systems were the dominant land systems of British India from 1793 to 1947. Under both of them the old body of custom was submerged by the formidable apparatus of law courts, fees, lawyers, and formal procedures. For with the introduction of some of the rights of private property in the land, the purchase and sale of zamindars' holdings were explicitly sanctioned by law. All of this was too much not only for the humble peasants, but also for the new landlords. Most of the latter could not raise the revenues required by the government and soon defaulted or sold out to merchants, speculators, and other sophisticated persons from the cities. The new landlords were interested only in the rents they could squeeze from the land; often they delegated the collection to middlemen who contracted to pay high sums annually. The latter sublet to other classes of middlemen, so that before long the unfortunate peasants of Bengal were supporting an impressive string of middlemen, speculators, and absentee landlords.

The ryotwari system also introduced some features of private property in land. The individual holders were registered and empowered to sell, lease, mortgage, or transfer their right to the use of the land. In contrast to the previous indigenous regimes, which had made more or less elastic demands, the British insisted on prompt payment of the stipulated sums. In cases of default livestock, household property, and personal effects might be attached, and the peasant might be evicted. The new system thus made mobile both the land and the peasant and left the way open for the growth in power of the moneylender and the absentee landlord.

Spread of Commercial Agriculture (1850-1947).—The older rural framework of India, weakened by the new land systems, was shattered by the spread of commercial agriculture, the production of crops for sale rather than for family consumption. Commercial agriculture grew partly because of the recurring need of the peasants for money to meet the mounting demands made on

them by the government and the landlords. Another reason was the fact that such a development was welcome to the British authorities. By the middle of the 19th century, Britain had passed through the Industrial Revolution. British industries were then the greatest in the world, and they kept on expanding. British manufacturers clamored for raw materials and sought good markets in which to dispose of their finished products. Under pressure from British merchants and manufacturers, India's coastal towns were linked with Britain in the 1840's by steamships, and the interior of India was covered after the 1850's by the most elaborate railway network in Asia.

Once the railways were opened, it became possible for the inland areas to produce for the world market. Wheat poured out of the Punjab, cotton out of Bombay, and jute out of Bengal. As commercial agriculture spread, the older practices associated with a self-subsisting economy declined. Since industrial crops (for example, cotton, peanuts, sugarcane, and tobacco) paid better than food grains, the peasants who could tended to shift over to them. In some districts the peasants shifted over completely to industrial crops and had to buy their foodstuffs from dealers. Villagers sent to market the cereal reserves traditionally kept for poor years. They became less prepared to meet poor harvests. Years of successive drought in the 1870's and 1890's led to great famines and agrarian unrest.

To produce crops for market the peasants required credit, and they turned to the moneylender, who came to occupy a place of unprecedented importance. Although in pre-British times the local moneylender extended casual credit to meet occasional needs, he occupied a subordinate place in the economy of the countryside. The new conditions, however, opened up a golden age for the moneylender. The demand for his services became an inescapable part of the peasant's life; to the government the moneylender was of invaluable aid in converting the peasant's crops into cash and passing on the land revenue. He was encouraged to expand his activities by the fact that he could now make a good and secure profit. If the peasants defaulted, he could use the new legal procedure to attach their lands, livestock, and personal possessions. Furthermore, from the middle of the 19th century the price of land rose rapidly, thereby encouraging the moneylender to broaden his operations. He began to take over the peasants' land and rent it out. The moneylenders grew in number and in wealth.

The same railroads which carried away the commercial crops brought back machine-made industrial products. The village artisans no longer were sheltered by the friendly backwardness of the older village commune, and the union of agriculture and hand industry which had been the basis of village life was disrupted. Under the impact of new forces the village could no longer remain a compact social and economic unit. The growing tendency was for each family to make ends meet as best it could. Deep in the interior of central India and in other areas difficult of access the handicrafts held on for a long time, but in the coastal zones and in the regions lying along the new railroads they declined. The village potter, tanner, dyer, oilman, and jeweler all faced strong competition from machine products.

Since 1850 a dwindling proportion of the village artisans have been able to subsist on what they have received for their services from the vil-

lage. Millions of them have had to find other ways to gain a livelihood or to supplement their scanty earnings from the village. In most cases the only avenue open to them has been agriculture, and they have added steadily to the great pressure on the land.

The increase in the number of persons on the land did not reflect itself in an increase in production. Rather a number of related factors endemic in the rural situation served to hold agricultural output down. The hierarchy of rights in the land which was elaborated during the British period established more securely than ever before in Indian history the power of landholders to take a substantial share of the produce of the soil. Persons who enjoyed such rights tended to become set apart from those who actually tilled. Where owners and superior tenants subsisted primarily on rents, the portion remaining to inferior tenants and crop sharers was so small as to keep them stripped of capital; where hired laborers were employed, they were drawn typically from the lowest castes or tribes. Timorous, uneducated, ill paid, and with no stake in any increase in output, these laborers could hardly have been expected to take an interest in advanced techniques or even to make proper use of better tools. Crop production methods essentially remained the time-honored ones passed on from generation to generation.

Associated agrarian problems, such as insecurity of tenure, fragmentation of holdings, and concentration of credit and marketing in the hands of moneylenders, retarded productive investment in agriculture. Families with superior rights to sizable areas found it more remunerative to allow their holdings to be cultivated by others. Rather than plow back profits into the soil in order to obtain higher returns, they preferred to skim off as much rent as could be extracted on the basis of customary methods of production.

A formidable block against modernization was thus provided by a complex of factors which may be summed up in the expression "built-in depressor." Its effects may be seen in the fact that from 1890 to 1947 agricultural output rose so slowly that we are justified in speaking of stagnation. Whatever increases occurred in output took place in industrial crops; there are reasons for believing that to a significant extent these increases were achieved at the expense of food grains.

Urban Economy.—India's urban life in the British period was shaped increasingly to meet the requirements of the economy of the United Kingdom. The chief cities served as centers for the outward movement of British manufactured goods. The factories which came into existence in these cities either were devoted to consumer goods and other light industries or were workshops for maintaining transportation services.

Indigenous enterprise made slow headway in 19th century India, partly because it came up against the power of the British mercantile houses. These houses had evolved a form of business enterprise peculiar to India: the managing agency. Under this managing agency system a single organization runs the affairs of a dozen or more concerns operating in different fields. The system arose when British merchant houses founded banks, opened coal mines, built jute factories, or started tea plantations. After 1850 the great British concerns played a predominant role in the economic life of India. Indians desiring to enter fields in which British managing agencies

operated found it sound or advisable to place themselves under the protection of one or another of these houses. Throughout the 19th century would-be Indian captains of industry received little if any government assistance. The first tariffs of even a moderately protective nature did not come into operation until the 1920's, and up to 1947 the great British shipping lines were able to operate freely in the Indian coastwise trade.

For India as a whole, the great bulk of the town dwellers are not factory workers but hand artisans, unskilled laborers, or servants. Large numbers of laborers are employed in construction and roadbuilding and on docks and railways. The middle classes in the cities consist largely of petty traders, shopkeepers, middlemen, sweatshop owners, and small absentee landlords. From their families come lawyers, schoolteachers, and the lower ranks of government employees. For the middle classes generally the struggle to make ends meet is a hard one, and only a small percentage achieves moderate comfort. In this more fortunate group fall the larger merchants and the successful lawyers, whose main practice is taken up with corporation law and suits about land.

Leaving aside the great British houses, economic power and influence in the cities became concentrated in the hands of a few thousand Indians who successfully established themselves as industrialists and financiers. It was only by 1939 that the Indian houses could be considered to have arrived. Since then all the established firms, British and Indian, have tended to work together to prevent outsiders from intruding into their domain.

Most of the leading Indian businessmen came from two tiny social groups: the Parsis of Bombay and the Marwaris of Rajputana. The most famous Parsi family is the Tatas. Relying almost solely on his own resources, Sir Jamsetji Tata (1839-1904) succeeded in founding at Jamshedpur in eastern Bihar the great Tata Iron and Steel Company. Besides textiles, iron, and steel, his descendants have large holdings in such basic industries as electric utilities, chemicals, machine tools, and trucks. The Marwaris originally were a group of moneylenders and merchants from northern Rajputana. Quick to take advantage of the new economic opportunities presented in the second half of the 19th century, they moved south to Ahmadabad and Bombay and east to Kanpur and Calcutta. Along with the Parsis, they were among the first to set up cotton textile mills. From these they expanded into every conceivable type of business. The wealthiest of the Marwari houses, that of Birla Brothers, Ltd., has interests in cotton textiles, sugar mills, paper companies, cement plants, jute mills, automobiles, trucks, insurance companies, newspapers, and weekly magazines.

Labor.—Factory employment in India at the end of the British period totaled about 2,000,000 workers. In addition, there were about 400,000 miners, more than half in the coalfields; and about 700,000 persons working on the railways. The great cities constituted the chief points of concentration for industrial labor. There were more than 100 jute mills in Calcutta, employing about 300,000 workers; about 100 cotton mills in Bombay with 150,000 hands; and another 100 cotton mills with 100,000 hands in Ahmadabad. Heavy industry was chiefly in the Calcutta-Asansol (coalfields)-Jamshedpur (steel) area, light industry was the specialty of Bombay, and Ahmadabad

was exclusively a cotton mill town.

The principal employers of factory labor were the British and Indian managing agency houses. Insofar as labor supply, wages, and industrial relations were concerned, these houses were in a fortunate position, at least from 1850 down to World War II. Throughout that period India's villages were raising a labor supply larger than that needed in the countryside, and the urban mill-owners could always count on new hands. These rustic recruits were generally from the lower castes, ill educated, timid, speaking different languages, and difficult to organize. Employers found that such laborers would accept the barest subsistence wages.

There was no need, the employers also found, to worry about the laborers' health, housing, sanitation, education, or recreation. The price of such neglect was an unstable and unhealthy labor force. A great many workers had come to the factories because they could not make a living in agriculture. Under the prevailing conditions they found they could not make do in the cities. Many workmen wandered back and forth between village and town. The annual rate of turnover in the mills reached 50 or even 75 per cent.

Down to World War II, India's labor leaders did not emerge from the ranks of labor; instead, they came from the subcontinent's uppermost strata or even from abroad. These leaders usually had political affiliations and carried their political quarrels along with them. While the British were still in power, the imperial authorities distrusted both the trade unions and the political organizations with which these were connected. Laws and ordinances made it difficult for the unions to function.

INDEPENDENT INDIA

When the Indian National Congress took office in independent India in 1947, it had already defined its major objectives for agriculture, industry and trade, and labor. For the countryside the first problem was to raise the standard of living of the masses. Agriculture was to be modernized, and the agrarian structure radically reformed.

The Congress simultaneously called for a rapid development of industry and public utilities "so that free India may develop into a cooperative commonwealth." It would be necessary "to prevent the concentration of wealth and power in the hands of individuals and groups, [and] to prevent vested interests inimical to society from growing. . . ." Therefore the Congress declared: "The State must . . . own or control key and basic industries and services, mineral resources, railways, waterways, shipping and other means of public transport." The system of managing agencies should be abolished, and private industry should be so regulated as best to further the broad interests of national industrial development.

For labor the Congress promised minimum wages, a decent standard of living, proper housing, better working conditions, and social insurance. While accepting the right of workers to form unions, the Congress avoided any reference to the right of those unions to strike. Instead, it promised to establish suitable machinery for the handling of industrial disputes.

Rural Development.—In the first three years of Congress rule at the center and in the states shortage of funds was frequently put forward as a reason for going slow on land reform, since the Congress program called for equitable compensa-

tion of landlords whose rights in land were extinguished. Beyond doubt, India faced many heavy expenses: millions of refugees from Pakistan needed help, the costs of the conflict over Kashmir were huge, and uncertainty about relations with Pakistan led to the allocation of half of the ordinary budget to the military. The question of compensation was eventually resolved by scaling down proposed payments, putting compensation in the form of long-term bonds, and passing (1955) a constitutional amendment making the question of such compensation not open to review by the courts.

Another reason for delay in initiating land reform was the problem of the adequacy of the food supply. From 1947 to 1952, India had poor harvests, and the government had further to strain its financial resources in order to import food. In these circumstances, opponents of land reform questioned the wisdom of radical changes lest these upset food production.

As finally enacted, the land reform legislation fell into two broad groups. In areas where the zamindari system prevailed, the new laws provided for the abolition of intermediaries; these are the famous zamindari abolition laws of such states as Bihar and Uttar Pradesh. In areas under the

patwari, to falsify the village records. Since the laws permitted landholders to cultivate through the use of hired labor or through special kinds of sharecroppers (*sajhidars* in Uttar Pradesh), many former tenants in Uttar Pradesh ended up either as laborers or as *sajhidars* of former zamindars.

In the ryotwari areas the tenancy laws had two main objectives. The first was to protect tenants against eviction by granting those of long standing permanent rights to the land they had been occupying. The second was to reduce rents by fixing upper limits at about one third or one sixth of the produce as against the widely prevailing equal division of the crop. In order to prevent their tenants from obtaining permanent rights to particular plots of land, the landlords took to moving them around from year to year or even from season to season. Furthermore, the landlords connived at the falsification of village records in order to evict old tenants who would otherwise have had full claims to occupancy rights. There were also many cases in which landlords compelled their tenants to sign documents affirming that they were merely hired farm servants (*naukar*).

In a number of states legislation was proposed or enacted to set a limit on the size of holdings. To forestall such ceilings landlords nominally divided their property among their relations or friends so that each of the newly created holdings fell below the proposed maximum.

While the land reform laws enacted in India in the decade after 1947 constitute the largest body of agrarian legislation passed in so brief a span of years in any country, they have proved to be full of loopholes. In effect, the frustration of land reform has carried along with it the frustration of numerous efforts at agricultural development. The grow-more-food campaigns, Community Development Program, National Extension Service Program, Shramdan (labor-gift) movement, Bhoodan (land-gift) movement, Gramdan (village-gift) movement, "Japanese" method of paddy cultivation, foreign technical assistance missions—none of these have been able to make much headway against the deeply rooted forces of the "depressor." Although the official statistics on agricultural output in the 1950's—shown in Table 1—record an increase in production, it would be premature to speak of a sustained upward trend.

Table 1—AGRICULTURAL OUTPUT, 1950–59
(According to official statistics)

Product and unit ¹	Average, 1949-50—	1955- 56	1956- 57	1957- 58	1958- 59
	1953- 54				
<i>Food grains</i>					
All food grains	56.4	65.8	68.7	62.0	73.5
Barley	2.5	2.8	2.8	2.2	2.6
Corn	2.3	2.6	3.0	3.1	3.0
Millet (all)	13.0	13.8	13.8	15.1	16.2
Pulses (all)	8.8	10.9	11.5	9.2	12.2
Rice	22.9	27.1	28.3	24.8	29.7
Wheat	6.8	8.6	9.3	7.7	9.7
<i>Other principal crops</i>					
Cotton ²	3.2	4.0	4.7	4.8	n.a. ³
Jute ⁴	3.7	4.2	4.3	4.1	n.a.
Oilseeds (all)	5.0	5.6	6.2	5.9	n.a.
Raw sugar	5.2	6.0	6.8	6.4	n.a.
Tea ⁵	619	637	668	673	n.a.
Tobacco	0.2	0.3	0.3	0.3	n.a.

¹ Unless otherwise indicated, millions of long tons.
² Million bales of lint of 392 pounds each. ³ n.a. = not available. ⁴ Million bales of 400 pounds each. ⁵ Million pounds. Source: data for 1949–50–1957–58 from India, Central Statistical Organization, *Monthly Abstract of Statistics*, March 1959 (New Delhi 1959).



Kulwant Roy

All-India Radio Station's Broadcasting House, New Delhi.

ryotwari system the laws provided further protection for tenants; the best known of these is the Bombay act of 1948, which was drastically amended in the 1950's.

While the zamindari abolition laws ended the zamindari system, they did not end the connection of all the former zamindars with the land. The zamindars were allowed to retain lands they could prove to have had under their personal cultivation—their home farms. In Uttar Pradesh such lands were known as the zamindars' *sir* and *khudkasht*. The years of delay before the reforms came into effect gave the Uttar Pradesh zamindars time in which to enlarge their home farms. Wherever they could, the zamindars cleared off tenants and resumed land for themselves. They also induced the village record keepers, the patwaris (Hindi

Perhaps the most fundamental change in the countryside has been the virtual disappearance of *begar* (Hindi *begār*) and other forms of forced labor. In the early years of the 20th century the great bulk of agricultural laborers in India could at best be called half free. In status and practice they are now almost fully free, though still subject to bargaining disadvantages of poverty.

Industry.—In the first dozen or so years after 1947 modern industry grew with unprecedented rapidity and expanded into many new fields. It is not much of an exaggeration to say that in this short period the country made greater industrial progress than in the entire century before independence. Behind this upsurge lay the government's determination to put an end to India's dependence on foreign manufactured products. (Production figures of certain important industrial products are shown in Table 2.)

Table 2—INDUSTRIAL PRODUCTION,
1948, 1951, and 1956-58

Product and unit ¹	1948	1951	1956	1957	1958
Cement	1,553	3,196	4,928	5,602	6,068
Coal	29,820	34,428	39,432	43,500	45,336
Cotton cloth ²	4,319	4,076	5,306	5,317	4,927
Cotton yarn ³	1,447	1,304	1,670	1,780	1,686
Electricity ⁴	4,572	5,856	9,660	10,872	12,372
Jute manufactures	923 ⁵	875	1,093	1,030	1,061
Pig iron, ferroalloys, and direct castings	1,464	1,824	1,958	1,906	2,110
Steel, crude ⁶	1,255	1,500	1,738	1,715	1,813
Steel, finished	856	1,051	1,264	1,282	1,222

¹ Unless otherwise indicated, thousands of long tons.

² Millions of yards. ³ Millions of pounds. ⁴ Millions of kilowatt-hours. ⁵ Pertains to 1949. ⁶ Ingots and metal for castings. Source: India, Central Statistical Organization, *Monthly Abstract of Statistics*, March 1959 (New Delhi 1959).

In this development, however, the place of private enterprise, foreign enterprise, and managing agency houses was much greater than the Congress had envisaged. When the party took office, India's business interests made it plain that they were opposed to any program of nationalization or comprehensive planning. They insisted that business be allowed a free hand in its choice of economic activity and be backed up by liberal government assistance. Meanwhile, they decreased their purchases of government bonds and withheld tax payments. Rather than expanding, they cut down on investment programs. In the face of this "capital strike," the government announced in 1948 that nationalization was to be postponed for at least 10 years, perhaps indefinitely. The only industries set aside exclusively for public operation would be munitions, atomic energy, and railways. The government reserved the right to operate in any other field or to establish any regulations it deemed necessary, but stated that private enterprise "has a valuable role to play." In the following year, the government added that foreign capital was welcome and could operate on the same terms as Indian, subject to one basic qualification: major ownership and control should be in Indian hands. By yielding to private Indian and foreign companies the initiative in selecting lines of industry and deciding on intensity of investment in these particular lines, the government in effect was giving up the policy of centrally planned economic development.

In addition to munitions, atomic energy, and railways, the government maintained and ex-

panded its operations in other fields in which it had been active even before 1947: communications, transportation, and electric power, especially hydroelectric installations. In these fields the striking innovation was the manufacture of basic equipment of many kinds, for example, machine tools and railway boilers and locomotives.

The second group of industries in which the government has taken an active role comprises lines requiring capital investment on the order of \$50 million to \$300 million. These industries include complete new iron and steel plants; a shipyard for turning out ocean-going vessels; and plants producing fertilizers, penicillin, and insecticides. Important assistance has been obtained from abroad. In some cases the aid came from foreign private enterprise; in others, as in the steel plant from the USSR erected at Bhilai in Madhya Pradesh, help was given on a government-to-government basis.

For its part, private business has also made big strides forward. There has been great expansion of such established industries as those



Gordon N. Converse, "The Christian Science Monitor"

Bhakra Dam, a great hydroelectric and irrigation project on the Sutlej River in northern India.

producing iron and steel, paper, small pumps, rubber tires, cement, soaps, and hydrogenated oils. New fields include the manufacture of bicycles, automobiles, buses, and trucks; diesel engines, large pumps, electric motors, and construction equipment; plastics, aluminum, and aluminum products; industrial boilers and air conditioners; rayon, textile dyes, and textile machinery; and fine chemicals, drugs, antibiotics, and other pharmaceuticals.

In this industrial expansion the biggest Indian agency houses were the most active. In the process they secured a still larger lead over their lesser rivals. Hand in hand with India's



Werner Bischof from Magnum

Factory workers of the Tata Iron and Steel Company at Jamshedpur ride to work in the early morning.

unprecedented industrial growth went a greater and greater concentration of economic power in a few firms.

Some of the purely foreign companies carrying on business in India also expanded their operations. Thus, the Indian government arranged with three oil companies to build large new refineries in India. The Burmah-Shell and Standard-Vacuum companies did so in Bombay, while the California-Texas Oil Company did so at Visakhapatnam. In its dealings with foreign companies the government pressed for a steadily rising percentage of Indians in the higher executive posts. A related policy called on the companies to alter arrangements whereby their offices in India merely carried out orders from headquarters abroad. Instead, they were pressed to establish companies domiciled in India, with Indians on the boards of directors, and local shares sold to Indians.

Transportation and Communications.—

As of 1959, the railway system of India extended for some 35,000 route miles. The system is the largest in Asia and, in terms of length, ranks among the first 10 in the world. Barring insignificant exceptions, all the lines are publicly operated, under the Railway Board of the central government. India's highway network (1959) is of the order of 300,000 miles, of which a third is hard surfaced. All the main cities and towns are linked by the government-owned national telephone system. Similarly, the radio network is purely public, under the Ministry of Information and Broadcasting. Domestic air services, nationalized in the 1950's, are handled by the government-controlled Indian Airlines Corporation. The only Indian line providing external connections is the government-controlled Air-India International. There are also a number of foreign airlines serving India, but no one of these runs so many flights as Air-India.

Labor.—During World War II the Communists made great strides in the trade union

movement. To remedy this situation the Congress Party and the government organized in 1947 a new body, the Indian National Trade Union Congress (INTUC), which within a decade became the premier trade union federation in the country. The Communists had the second largest group, perhaps half the size of INTUC or even less; in addition, there were two sets of Socialist-oriented unions and various smaller bodies.

With help from INTUC the Congress has been fairly successful in its announced aim of establishing an industrial truce which would give the most favorable setting for accelerated economic development. To avoid strikes the government has established a compulsory procedure of conciliation and adjudication, with a hierarchy of labor tribunals. The main bias of these tribunals has been in favor of a scaling upward of industrial wages. The fact that the truce has brought more take-home pay accounts in large part for the support given to it by organized labor. Employers have naturally protested, particularly at the slowness of the tribunals. In view of the substantial profits which industry has been enjoying since 1947, however, they seem to have decided that such inconveniences are less troublesome than strikes.

The total industrial labor force has expanded rapidly, reaching about 2,750,000 by 1959. In a number of cases private companies and government corporations have gone to much trouble to provide good working conditions, proper housing, and other amenities. In most industrial establishments, however, conditions are bad. The labor legislation in the statute books is comprehensive, but serious implementation has scarcely begun.

Economic Planning.—India has had a First Five-Year Plan (1951–1956) and a Second Five-Year Plan (1956–1961), and a third plan was scheduled for 1961–1966. An increasing amount of time and labor has gone into the preparation of these documents, but it is no easy task to specify

the achievements of planning. Essentially, planning in India has meant the programming of capital expenditures by the central and state governments. The First Five-Year Plan was drawn up very cautiously; it provided for governmental expenditure on planned items (a good few of which represented projects under way before the launching of the plan) of the order of 20 billion rupees (the Indian rupee is valued at 21 cents in United States currency). The main lines of the Second Five-Year Plan were sketched in 1954 and 1955, when harvests were unusually good. The planners more than doubled the target for governmental outlay on planned items, which was placed at 48 billion rupees. Simultaneously, they called on nongovernmental bodies and individuals to invest in their own activities an additional 24 billion rupees. One of the most striking aspects of the second plan was its vagueness about sources of finance. Dependable resources were expected to provide only 24 billion rupees of the governmental outlay. The remaining 24 billion rupees were to be provided by deficit financing plus hoped-for foreign loans. As to the sources of finance for the private sector, the ideas of the planners were even less precise.

In the first few years of the second plan the planners found that they had seriously underestimated the capital required to reach their production targets, and that they had greatly overestimated their domestic financial resources. Simultaneously, they found that private business had ordered capital goods from abroad at a much more rapid rate than had been anticipated. Moreover, food harvests for the years 1956-1958 leveled off; heavy imports were made. Foreign exchange resources ran dry just when it was plain that inadequate resources were being raised at home. The planners themselves realized the seriousness of the situation, but were unable to devise effective measures for dealing with it. Meanwhile, the first drafts of the Third Five-Year Plan were being outlined. These drafts called for a plan perhaps 50 per cent larger than the second plan. Despite the difficulties already encountered, it seemed to be assumed that basically the same sort of planning somehow could be made to work.

See also 3. *The Land and Its Resources*; 5. *Way of Living*; and separate articles on BANKS AND FINANCE—4. *Commonwealth of Nations* (India); RAILROADS—8. *Asia* (India); TEXTILE FABRICS.

DANIEL THORNER,

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5. WAY OF LIVING

Indian society is composed of many separate fragments which reflect almost every conceivable basis of social differentiation, and which coexist through mutual tolerance and general agreement on the status and functions of the various groups. The geographic regions where different languages are spoken vary considerably in their historical traditions, cultural patterns, and complement of castes. Within each linguistic region marked contrasts in custom and tradition parallel class and caste differences. Cutting across linguistic and class divisions are the communities—large aggregates of people defined by some common denominator, such as religion, ethnic affiliation, or area of origin. Since Indians feel no need to make these diverse groups conform to a single set of



Kulwant Roy

An open-air class at a school in northern India.

practices and beliefs, a bewildering heterogeneity prevails. The underlying unity of the country is derived from the large fund of cultural traditions shared by most groups and from the dominance of certain national elites, who set the goals and the ideology for the nation as a whole.

Family.—By far the most important social unit in India is the family. It is the seat of primary loyalties, and its interests are considered superior to those of the individual. Kinship, which extends as far as ingenuity can trace the bloodline, carries with it an elaborate set of duties, rights, and obligations. The effective unit is the joint family, which usually comprises two, three, or even four generations in a patriarchal, patrilineal, and patrilocal system. This means that the oldest living male progenitor is the head of the family, descent is reckoned through the sons, and brides are brought into the family to live (a daughter, upon marriage, moves to her husband's house). While matrilineal systems still survive, particularly among the Nairs (Nayars) of the southwest coast and the Khasi tribes of Assam, and evidences of earlier matriarchal traits are found scattered throughout the country, the overwhelming majority of Indian families are male centered. New families are created when established units break up upon the death of the patriarch or upon the departure of one or more brothers and their families. The new units acknowledge a common source, however, and maintain a seat (usually where some family land is held) and have household gods peculiar to the family and to its place of origin. In the pure type of joint family property and income are shared among all the members, but increasing mobility and urbanization have produced a freer system in which members merely share responsibility for the support of nonworking dependents. The strictly conjugal family of husband, wife, and children is commoner in the cities than in the rural areas, but it is still not the dominant pattern. Although marriage is almost universal (less than 5 per cent of those of marriageable age remain unmarried), the large cities house many men separated from their families, which have remained in the villages.

Within the family roles are sharply differentiated by age and sex. Until his final declining years a man's status increases as he gets older and, in general, depends upon his standing with respect to the main line of inheritance and upon his contribution to the economic well-being of the family. The role and status of women are more complex. In childhood a girl plays freely with others of her age group, although she early assumes responsibility for the care of children younger than herself. As puberty approaches, however, she is drawn into the exclusive company of older women and is trained for marriage. At or near puberty she is likely to be married and to move to her husband's household, where she assumes the position of an apprentice under the supervision of the women of her new home. In upper-caste groups a dowry system is the commonest, while the bride price is found among other groups. Except among the most cosmopolitan urban elite groups, marriages are still arranged by the parents, with or without the prior consent of the intended bride and groom. A woman achieves full adult status when she gives birth to her first child, preferably a son. From then on her status reflects that of her husband and her sons. Should she become a widow, her status is greatly lowered. Divorce and the remarriage of widows are forbidden in most upper-caste Hindu groups, but they are common among non-Hindu groups and the lower strata of Hindu society. While woman's traditional role requires her to be a passive follower of her husband's wishes, as in all cultures this is subject to constant negotiation. The status of women is improved by the Hindu Succession Act of 1956, which gives them enhanced rights of inheritance in family property.

Within the general framework of the extended family details of such matters as kinship structure, marriage customs, family rituals, and the selection of a marital partner vary tremendously. All groups specify some kinship limits within which a person may not marry (exogamy) and others within which he must marry (endogamy). For upper-caste Hindu groups exogamous boundaries are usually established by some form of the Brahmanic gotra system, which prohibits intermarriage among persons who trace their descent from a common spiritual ancestor. There is also an incest taboo called *sapinda* (Sanskrit *sapinda*), which in its extreme form precludes intermarriage between persons whose relationship is within six degrees on the father's side and four degrees on the mother's side. In the south, to the contrary, the preferred mate is the cross-cousin (for a man, the daughter of his maternal uncle). Endogamous boundaries are usually the caste or the subcaste.

Caste.—Among the Hindus and Jains, and to a lesser extent among the other religious divisions, a group of families forms a caste which may vary in size from a few hundred to several million. Membership in a caste is by birth and is unalterable. An individual's choice of a marriage partner is generally restricted to his own caste, and even in cities intercaste marriages are rare. The castes are arranged hierarchically according to the prestige of their traditional occupation and the extent to which they observe such social practices as special food taboos, strict vegetarianism, and the prohibition of widow remarriage, according to traditions prescribed in Sanskrit literature.

The caste system is intermingled inextricably

with Hinduism, deriving part of its strength from a religious philosophy which justifies a person's present position by his deeds (*karma*) in previous existences and promises a better status in his next existence if he fulfills his duty (*dharma*) by conforming to the rules of his caste today. While caste is thus sanctified by religion, it has many social pressures to support it. Other religious groups, such as the Sikhs, Muslims, and Christians, while doctrinally opposed to caste, have nevertheless formed castelike groups, which frequently reflect their affiliation prior to conversion from Hinduism. Social distance between the castes is symbolized and maintained by taboos on intermarriage and on eating together and by the restriction of access to temples, wells, schools, and other public places. Where the difference in status is very great, physical contact is prohibited.

The relative position of the caste varies from one locality to another, and no single locality contains the complete range of more than 2,000 distinct units called castes. In general, however, the castes are fitted into the broad class divisions of the four *varnas* (Sanskrit *varna*) mentioned in the Vedas and systematized and stabilized in later Brahmanical literature. The Brahmins (*Brahmana*, priests), Kshatriyas (*Kṣatriya*, warriors and rulers), and Vaisyas (*Vaiśyas*; Sanskrit *Vaiśya*, commons) comprise the three upper groups. Men of these groups wear the sacred thread and are called twice born (*dvija*), because as boys they undergo a ritual initiation ceremony (*upanayana*). Sudras (*Shudras*; Sanskrit *Śūdra*, serfs), the fourth *varna*, rank below this group. Outside the *varna* system entirely are the castes labeled untouchables, *Harijan*, or scheduled castes, as well as various tribal groups which have not been assimilated to Hindu society. The Indian Constitution forbids the enforcement of the disabilities arising out of untouchability, and the Untouchability (Offences) Act of 1955 provides legal penalties for its practice. Both the central and the state governments have done much to raise the social and economic level of these classes.

An individual may raise his own esteem and influence and that of his family by the acquisition of wealth (especially land), education, political power, and special religious merit, and over the generations whole castes often attempt to rise in the hierarchy. Individuals are not restricted to traditional occupations, although some occupations are monopolized by one or a very few castes, and all castes can and do engage in agriculture. With greater vocational opportunities the concordance between caste and occupation is decreasing in modern India. In the cities education has become a much more important determinant of occupation, although the different castes are still unequal in their educational attainments.

Village Life.—It is in the villages, where more than four fifths of India's people live, that caste appears in its fullest development, providing a stable division of labor and a well-defined system of rights and duties. The completely self-sufficient village or cluster of villages is now found only in isolated areas. The motor bus, the radio, the centralized market, and the proliferation of governmental functions and functionaries have made the villages dependent on the outside world. Nevertheless, the predominant village structure, though weakened, is much the same as it has been for centuries.

Except for a few specialized villages such as those of fishermen or herdsmen, the cornerstone of

village life is the land and the agricultural cycle. About 70 per cent of the people of India depend on agriculture for their livelihood. The leading agriculturists in the villages (48 per cent of the total population) either own the land or have superior tenancy rights. Below them are the lesser tenants (9 per cent) and a growing class of landless agricultural laborers (13 per cent). The uneven distribution of the land has produced an aristocracy: 25 per cent of the village families hold 84 per cent of the land. In most areas the majority of holdings consist of less than five acres. Land is usually held by a joint family, and upon a division of the family each child receives a share. Increasing population density and generations of subdivision have reduced many holdings to an uneconomic size and scattered them in unconsolidated fragments.

Aside from agriculturists, each village usually has a set of separate castes which provide it with artisans and servants. This segment varies from village to village, but most commonly it includes one or more families with the occupations of blacksmith, carpenter, barber, potter, oil presser, washerman, sweeper, cobbler, and scavenger, and perhaps also a weaver, a temple servant, and a moneylender-shopkeeper. In earlier times some or all of the artisans and servants were paid from shares of the harvest, and they were attached in traditional patron-client relationships (called *ya-jamāni* in north India) to the agricultural families and to each other. These networks of mutual obligations have been undermined by the growing tendency to deal in cash rather than in kind, by the temptations of urban employment, and by the development of an external source of supply for many services previously provided within the village itself.

Most Indian villages are nucleated—that is, they fall in a cluster of 50 to 500 houses strung along a few narrow lanes and surrounded by their fields. At the 1951 census, 26.5 per cent of the rural population lived in villages with fewer than 500 persons; 48.8 per cent, in villages housing between 500 and 2,000 persons; 19.4 per cent, in villages of between 2,000 and 5,000; and 5.3 per cent, in villages of over 5,000. Truly dispersed households are found only in the Himalayan area, but in Bengal there are clusters of single family homesteads; in the Punjab there are dispersed hamlets; and linear strip villages are not uncommon along the main rivers and along the roads in Kerala. Each village usually has four or five clearly demarcated social areas, including one outside the central cluster for the lowest caste. Even the humblest house is likely to have a walled-in open space where most of the family living takes place. But no matter what the geography of a specific village, poverty, petty tyranny, and repetitiveness are the common pattern. As a respite from the unending routine, the religious festivals, the happy rites of passage, and the frequent weddings take on a special significance. They also drain a disproportionate share of the villagers' scant cash income and sometimes add to an already staggering inherited family debt.

In 1952 the Indian government launched a massive Community Development Program to transform the economic and social life in the villages in the hope of arresting the downward spiral of agricultural life. Together with the less intensive National Extension Service Program, it had reached 80 million persons and about one fourth of the villages by the end of the First Five-Year



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Acharya Vinoba Bhave (left), leader of India's land-for-the-landless movement, maps a local campaign.

Plan (1951-1956) and was scheduled to cover the entire country by the end of the Second Five-Year Plan (1956-1961). The program's goals included increases of 28 per cent in agricultural production and 17 per cent in agricultural income, the provision of 2 million additional jobs in the rural areas, and the establishment of a road, a post office, and a telegraphic office within five miles of each village. The unit of operation is the Development Block, which contains an average of 100 villages with an aggregate population of 60,000 to 70,000 persons and an area of 150 to 170 square miles. Funds are supplied mostly by the central government, but the projects are administered and executed within the states.

The program has a staff of 100,000, but the key position is the lowest, that of the worker who is in charge of seven villages and actually instigates the changes. His task is essentially one of persuading the villagers to accept such innovations as improved plows, seeds, and planting techniques, which are disseminated by the technical departments of the government, and to mobilize them to build such community facilities as roads, irrigation ditches, wells, sanitary facilities, and schools, which they can produce with only a little outside capital. He is also responsible for promoting various changes in social organization which the government considers essential, including the development of cooperatives and village panchayats (councils), the consolidation of holdings, the encouragement of handicrafts and small industries, the organization of programs designed to assist the weaker elements of the village community, and the improvement of the lot of the scheduled castes and tribal groups. It is small wonder that, when successful, the program is called a rural revolution. Assisted by favorable climatic conditions and initial enthusiasms, the results were generally impressive during the First Five-Year Plan, although some sections of the country lagged behind the rest. Subsequent estimates were less sanguine; visualized a longer, harder pull; and suggested the need to concen-



Balder from Rapho Gullumette

Roadside restaurant in Chandigarh, capital of the Punjab. In the background is the capital's Secretariat building.

trate efforts on the key problems of agricultural improvement, postponing welfare provisions to a later date.

One of the major criticisms of rural development is that the benefits from the program have by and large gone to those elements in the village which are already economically well off. A non-official program of national importance, aimed in part at correcting this tendency, is the Bhoodan (land-gift) movement, begun in 1951 by Acharya Vinoba Bhave, a disciple of Mohandas K. Gandhi. Bhave and his followers travel from village to village requesting donations of land to be redistributed to the landless agricultural laborers and poorer tenants in the villages. By 1958 about 4.4 million acres had been donated, and of this approximately 1 million acres had been redistributed. More orthodox procedures for land reform are various land tenancy acts passed by state governments. Under these acts land is acquired by the state, ceilings are established on holdings, absentee owners and rent-collecting intermediaries are outlawed, and a minimum size is set for holdings in order to prevent further fragmentation. Evidence of the success of such legislation is conflicting.

City Life.—India's urban areas grow at a very rapid pace, and the large cities grow the fastest of all. While only a little less than one fifth of the population was classified as urban at the 1951 census, each of the 10 largest cities more than doubled its population between 1931 and 1951, by which time there were 32 cities of more than 200,000 inhabitants. This growth was given further impetus by the immigration of some 8 million Hindu and Sikh refugees from Pakistan to the major metropolises of northern and western India. The marked growth of cities is also a result of increasing economic pressure in the rural areas (more than one third of the city dwellers of the 1950's had migrated from villages), but there has been no compensating expansion of the economic base. The number of workers in organized manufacturing industries has remained relatively con-

stant, aggregating only 2.5 million in 1951, and most city dwellers are employed in service and distributive occupations which add little to the national income. The results can be seen in the deepening poverty of the cities, in the proliferation of rural housing types in uncongenial urban slum settings, and in the overflow of the population into the streets in search of living quarters.

The urban housing shortage, already acute, worsened in the 1950's, and congested areas in industrial cities reached densities of 700 or more persons per acre. House styles tended to be of a rural type without the saving grace of open air and sunlight found in the villages. In 1953-1954 a national sample survey was made of conditions in 53 towns and in the cities of Bombay, Calcutta, Delhi, and Madras. It found that nearly one fourth of the houses had plinths, walls, and roofs of mud. About 44 per cent of the houses had one room; 28 per cent, two rooms; 12 per cent, three rooms; and only 16 per cent, four or more rooms. About 46 per cent of the houses had less than 100 square feet per head. These figures do not tell the full story of the urban slum building itself, called *bustee* (Hindi *basti*) in Calcutta, *ahata* in Kanpur, *cheri* (Tamil *cēri*) in Madras, and *chawl* (Hindi *cāl*) in Bombay. Perhaps the most livable is the *chawl*, which is usually a three- to six-story building with approximately 20 one-room units to a floor, each about 120 square feet with an additional kitchen of 60 square feet. At one end of the floor is a common latrine and bath. The rent of 50 rupees per month for each unit is too high for a laborer's income, and two or three families often occupy the same cubicle. The housing shortage and spiraling rents have pushed even middle-class families further and further down in the housing scale. The rows of tenements are separated by narrow lanes that rarely see the light of day, a constantly running water tap serves an entire neighborhood, and open sewage gutters and overflowing trash bins add to the squalor. Problems of slum clearance, including compensation and displacement, are beyond the means of the municipal improvement trusts established in most cities to fight urban blight. Construction in the private sector of the economy tends to concentrate on expensive houses which charge high rents, little capital is available for housing, and cooperative housing has made slight progress. Moreover, since improvements are economically nonproductive, their priority is likely to remain low in governmental development projects.

In the center of each town there is usually a bazaar, a series of parallel strips crowded close together, each segment offering a single line of wares. Stalls ordinarily open at the front, and the shopkeeper sits on the veranda facing the street. Each of the larger cities has a center of shops on Western lines with glass fronts and rows of counters. If the town or city has been an administrative center, it has a cantonment and civil lines where the military, civil service, and European sections of the population resided. These areas contrast starkly with the jumbled, crowded sections elsewhere. In any available spot there are squatters' shacks made of corrugated iron, reed and wattling, mud, or whatever else is handy.

Most cities are sharply divided into sections, relatively homogeneous as to class, ethnic origin, and economic position. The upper stratum is composed of remnants of older elites—absentee landowners, rulers of former princely states and their dependents, religious leaders and scholars,

and wealthy traders and merchants of such special mercantile communities as the Parsis, Jains, Khojas, Marwaris, and Chettisars. The most important urban elite, which either includes or dominates the older wealthy classes, is the middle-class group of professional men, government servants, and intelligentsia, which has absorbed part of the Western cultural heritage in varying proportions and degrees of harmony. Its influence far outweighs its numbers. At the highest estimate this elite includes the 5 million persons literate in English, but several hundred thousand out of a population totaling about 397 million in 1958 is a more realistic estimate. While this group is almost entirely urban, it not only sets the tone of the cities, but also formulates the unifying goals of the country. The unquestioned national leadership of the elite stems from a number of factors, including its service to the nation in the achievement of independence; the general high regard for education and the professions; the national commitment to rapid modernization; and the group's control of the governmental machinery, which affects most aspects of society.

The city has a much greater range of occupations than the rural areas, and an individual must therefore rely upon many more persons to supply his needs. He comes into contact with more and more people but in a more impersonal and specialized relationship. Some of the needs of the city dweller for group membership are met by the development of voluntary groups and associations, but the village and the original rural base of the family draws the temporary urbanite when he is ill, ready to retire, or faced by a major family crisis. The temporary nature of urban residence is reflected in the distorted sex ratio (it is as low as 570 females for every 1,000 males in Calcutta), which is a result of the tendency of men to go to the city for what they consider a short stay, leaving their families in the village to await their return. The stay is rarely short. Nevertheless, urban households are larger than those in rural areas, averaging 6 persons as compared with 5.5. This is an indication of the pressure on housing and of the size of the dependency load which a city dweller assumes once he is established.

Demographic Pattern.—Underlying many of India's problems and running a race with its development is its population growth. India has an estimated crude annual birth rate of 40 per 1,000 persons and a death rate of about 27, providing a natural increase of 1.3 per cent annually. This rate is not excessive. In the 1950's, North America was growing at a rate of 1.7 per cent per annum, Africa at a rate of 2.2 per cent, South America at 2.4 per cent, and the world as a whole at 1.6 per cent. Several factors, however, make India's growth a source of difficulty. In the first place, the base population is so large that the actual number involved in the relatively low rate of growth is over 5 million persons a year. In the second place, pressures on the food supply already require India to expend a considerable portion of its foreign exchange on the importation of food. In the third place, the rate of growth is not the same throughout the country, being heaviest in those areas where the greatest density and pressure on resources already exist. In the fourth place, the necessity of allocating a substantial portion of future economic growth to the additional population hampers attempts to raise the general standard of living. Finally, by

the 1950's India was only at the halfway mark in a process which was expected to increase the rate of growth before a decline in births restored the equilibrium.

As in most 20th century underdeveloped countries and in Western countries in previous centuries, the spurt of population in India was precipitated by a sharp decline in the death rate, produced by relatively rapid and thorough control of such major epidemic diseases as plague, cholera, smallpox, influenza, typhoid fever, and typhus. While these diseases were still prevalent in India in the 1950's, inoculation campaigns had cut their mortality rate to less than 300,000 deaths annually. Malaria, responsible for about 800,000 deaths annually, with perhaps 57 million persons suffering from it, was being controlled by extensive DDT spraying, which was expected to produce a further decline in the death rate. India was also giving high priority to the reduction of infant and child mortality, and between 1950 and 1955 infant mor-



Gordon N. Converse, "The Christian Science Monitor"

A policeman directs traffic in a Calcutta street.

tality decreased from 127.1 to 99.9 per 1,000 live births. Further progress in this field would have a double-edged effect. Not only would it reduce the sizable death rate, but it would enable many more children to survive into the fertile ages and thus would raise the birth rate even further. The only major disease with a high mortality rate which was clearly on the increase was tuberculosis, which accounted for as many as 500,000 deaths a year. An extensive BCG (*Bacillus of Calmette and Guérin*) campaign sponsored by the United Nations Children's Fund and the World Health Organization had resulted in the inoculation of more than 24 million persons, and the Second Five-Year Plan was attempting to reach the entire susceptible population under 25 years of age. Meanwhile, however, partly as a result of urbanization and declining nutritional levels, the disease was increasing rapidly. Other communicable diseases, such as trachoma, filariasis, and venereal diseases, while still high in incidence, did not directly affect the mortality rate.

Although the death rate can be reduced by relatively efficient and easy methods, a reduction in the birth rate is much more difficult. The Indian government is one of the few that have adopted birth control as an element in state policy. While studies have shown that sizable sections of the population are willing to state a readiness to accept family limitation, field experiments have been conflicting in their reports of the actual success of birth-control programs. Initial trials of the rhythm method were not successful, and the central government adopted the more cautious approach of making advice and assistance available when they were sought. In two Indian states, Madras and Mysore, campaigns were started to encourage mass sterilization after the third child, offering free hospital care and a premium of 25 rupees.

While there are no religious barriers to birth control per se, many institutional pressures promote high fertility. There do not seem to be marked differences in fertility between classes, occupational groups, income groups, or urban and rural residents. While there is some evidence pointing to an advance in the age of marriage, this is largely among women under 20 and thus promises no decline in fertility. A major decline in the birth rate probably awaits changes in the factors that encourage high fertility, such as early and universal marriage, the high prestige accorded women upon the birth of sons, the heavy infant mortality, and the religious encouragement of fruitfulness.

The demographic pattern places special burdens on the economy, for the low average age of the population is one factor accounting for the heavy load borne by the economically productive. The high birth and death rates produce a young population: 13.3 per cent of the population was under 5 years of age and 47.5 per cent under 20 years of age at the 1951 census. A boy born in

that year had an average life expectancy of 32.5 years. Only 29.3 per cent of the population was self-supporting and 60.1 per cent was classified as nonearning dependents in 1951. The burden fell largely on agriculture, from which 68.1 per cent of the self-supporting population obtained its livelihood. This dependence on agriculture has made population density vitally important. The high density regions are the Gangetic Plain in the north (832 persons per square mile in 1951) and the coastal strips on either side of the southern peninsula. The Deccan and the western thrust of Gujarat and Kathiawar are of medium density, and the mountain fringes and the desert of Rajasthan (61 persons per square mile) are of low density.

Dress.—The commonest garment for Indian men is the dhoti (Hindi *dhoti*), a four- to five-yard white cotton cloth wrapped around the waist and tucked between the legs. There are variations in its drape, length, texture, and quality of border adornment. In Bengal one end hangs loose in front, while in Maharashtra both ends are passed between the legs and tucked into the back waistband. The poorer peasant or laborer wears his dhoti very short, and it is made of low quality cloth; that of the well-to-do man hangs in full folds from the waist and is made of fine muslin with a border edged in silver or gold thread. Working-class Muslims and some non-Muslim peasants wear a lungi (Hindi *lungi*), a two-yard piece of cloth, frequently checkered, which hangs loose and is wrapped around the waist like a sarong. In the Punjab loose-fitting pajamas called shalwar (Persian *shalwār*) are worn. If a shirt is worn, it is long and hangs outside the lower garments. In the cities and among the cosmopolitan groups in the towns and rural areas, Western dress is common for men. A three-quarter-length coat called achkan, buttoned all the way up the front and topped with a short, stiff collar, is worn as the official Indian costume on formal occasions.

Most Indian women wear the sari (Hindi *sārī*), a bordered length of cloth from six to nine yards long, which is draped loosely around the entire body and frequently covers the head as well. Except in lower-class groups, where it may be the sole garment, it is normally worn over a half slip. The sari is wrapped around the waist several times, making pleats in front, and then thrown across the chest and shoulders. Either a full blouse or a short, halterlike garment called a choli (Hindi *choli*) is worn on the upper body. The quality of the sari ranges from the drab blue or white of the peasant's workaday sari to the heavy gold brocade or fine gold-threaded silk sari of the rich. A few Indian women, particularly among such highly Westernized communities as the Parsis, Christians, and Anglo-Indians, wear dresses. In the Punjab women wear the shalwar topped by a long shirt, and in scattered places in north India a full, flowing skirt is worn.

Footwear for both men and women consists usually of sandals. For men distinctive styles of headdress indicate regional affiliation, religious community, or social class. Aside from the many ways of wrapping the turban, special headwear includes the traditional Parsi hat of shiny starched black alpaca in the shape of a rimless bowler; the Muslim hat, preferably of angora wool; and the Gandhi cap, an unadorned visorless cap which originally denoted membership in the Congress

Veiled Muslim women enter the polling place to vote in India's general elections.

Kulwant Roy



Party. Women usually wear no headdress other than a shawl or the end of the sari.

Food.—Most caste Hindus are vegetarians, varying in the strictness with which they observe the religious prohibition against meat. For Muslims, Parsis, and Christians, fowl, mutton, buffalo, and goat are the commonest meats. These are usually cut into small pieces and served with a curry. In the coastal regions several fine varieties of fish are served. In general, however, the diet is vegetarian, consisting mainly of grains (wheat, rice, millet, and barley) and legumes (grams, beans, and pulses). Wheat, usually served in baked or fried cakes, is the staple in northern and western India. The chapatty (Hindi *capāṭī*), the commonest form of bread, is a round, flat cake made of whole wheat flour and baked on a convex iron plate. The *puri* is like the chapatty except for the addition of some shortening, but it is fried in deep fat; the *parāṭa*, a third kind of bread, is cooked on a convex metal pan. In eastern India and in the south rice is the staple. Usually it is simply boiled, but mixed with ghee (Hindi *ghī*, clarified butter) and spices it becomes pilau. Corn, barley, and the millets are served alone or as supplements to wheat and rice dishes. Primary sources of proteins are the grams and pulses, such as *mung* (a green pulse), *channa* (Hindi *canā*, a chick-pea), and *arhar* (the pigeon pea), which when split and dried are called dal (Hindi *dāl*).

Vegetables include most of the green leafy vegetables, especially spinach and mustard and radish greens, as well as gourds, eggplant, okra, cucumbers, cabbage, turnips, and potatoes. India is well endowed with a large variety of fruits. Mangoes, undoubtedly the most popular, occur in several dozen varieties and are served in many forms. Most of the citrus fruits are cultivated, and guavas, tamarinds, papayas, custard apples, jack fruit, breadfruit, melon, gooseberries, pomeles, and pomegranates also are plentiful. In the hill regions such temperate zone fruits as apples, pears, strawberries, and cherries are grown. Milk products, especially curds, and a great variety of sweets round out the diet.

Most Indians eat a very light breakfast upon arising, a heavy meal at 11 or 12 o'clock in the morning, and a lighter meal between 7 and 9 o'clock in the evening. In the towns and villages tea is consumed throughout the day.

See also 2. *The People*; 13. *Religion and Philosophy*; 14. *Law*; and separate articles on CASTE; FESTIVAL—Other Living Religions; MARRIAGE, HISTORY OF; POPULATION.

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6. EDUCATION

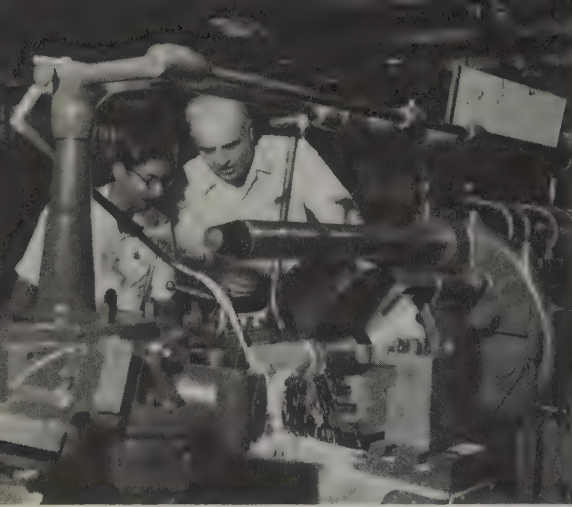
Educational System.—India's educational system is a mixture of a number of different traditions. In earlier days there were in the villages *tols*, schools for training caste Hindus, particularly Brahmans, in the traditional lore and sacred learning; *parishads*, assemblies of learned men for the instruction of the young; and *pāṭhśālās*, more formal primary schools open to all castes except untouchables, and taught usually by village priests. For Muslims schools known as *maktabs* were attached to the mosques, and independently operated madrasahs offered instruction at the secondary level. For the wealthy there was a host of private tutors.

The spread of formal schools under either government aegis or government regulation has made heavy inroads on the traditional system. In the late 1950's about 40 per cent of the children from 6 to 11 years of age and about 29 per cent of those from 12 to 14 years of age were enrolled in formal schools. Of the 366,686 schools recognized by the government in the 1955-1956 school year, about one third were private institutions, in the sense that they were owned and operated by nongovernment groups, particularly religious organizations. Nevertheless, the overwhelming majority of private schools receive governmental subsidies, and all recognized schools must follow syllabuses and their students must pass examinations set by state or local governments. Out of 33,923,000 students enrolled in the school year 1955-1956, approximately 10 million were in private institutions receiving government aid, 1 million in unaided schools, and the rest in schools run either by district or municipal boards or directly by the various states or the central government.

The full educational cycle normally begins with the primary school: there are few preprimary schools in India. Many of the primary schools have only one or two teachers, who instruct all grades from the first to the fourth. Middle schools carry the student from the fifth through the eighth grade, and secondary schools take him through the eleventh grade. Gradually the middle schools are disappearing, their coverage being divided between the primary and the secondary schools. Until India became independent in 1947, the schools were either vernacular or Anglo-vernacular. Schools of the former type were considered to offer a terminal education, while those of the latter type prepared students for college. With the de-emphasizing of English and the growing importance of vernacular instruction, however, these differences are being obliterated.

At the end of his secondary schooling the student takes a general examination, set either by a state board or by a university, which qualifies him as a matriculate. This is usually the lowest educational level to make him eligible for a white-collar job. His standing in the matriculation examination also determines his eligibility for admission to a college or university. Normally he then proceeds to a college, and at the end of two years takes another standardized examination, called the intermediate, and after another two years receives his bachelor of arts or bachelor of science degree. Following this there are various professional schools and postgraduate courses taught at universities.

Higher educational institutions are of several kinds. The bulk of the teaching is done in colleges of arts and sciences, of which there were 712 in 1958; professional colleges, numbering 346; and special education colleges, numbering 112. The 37 universities are divided into three types. The oldest of these is the purely affiliating university (only 5 were left in 1958), which follows the British pattern whereby the university does not itself undertake any teaching but prescribes courses of study, conducts examinations, and awards degrees and diplomas for the colleges affiliated with it. The second type, comprising 20 universities, adds some teaching, usually at the postgraduate or postintermediate level, to its main task as an affiliating body. The third type, represented by 12 universities, is a



UNESCO

A machine shop in Kharagpur's Institute of Technology.

residential and teaching unit controlling directly all the colleges as subdivisions. A university may have as many as 136 colleges (Calcutta) or as few as 1 college (Aligarh) attached to it.

Educational Problems.—There are many problems associated with education in India which press for a rapid solution. In the first place, the size of the task, given India's resources, is almost prohibitive. According to the 1951 census, 19.9 per cent of the people over 10 years of age were literate. The proportion varied from 58.3 per cent in Travancore-Cochin (roughly equivalent to the new state of Kerala) to a low of 5.8 per cent in Himachal Pradesh and 8.6 per cent in Rajasthan. Low salaries and the reluctance of educated persons to reside in the villages hampered the recruitment and diffusion of teachers needed to reach the goal of universal compulsory education through the primary level by 1961. A high turnover in the lower grades and frequent lapses into illiteracy have made the task more difficult.

The spread of basic education and its integration with the predominant academic system have not been easy despite strong official backing. The increasing use of vernacular languages has been purchased in part at the expense of the ability of students to use English and a consequent limitation of intellectual access to the West. The decline of English and the emphasis on the vernaculars as media of instruction threaten to destroy the nationwide unity of the educational system. Moreover, the gap in technical and professional education is seriously hindering India's program of rapid economic development. The examinations-centered system, with its almost ritualized curriculums, served originally to standardize an extremely diversified educational structure, but it has led to the practice of rote memorization among students and to a tendency toward inflexibility in the content of instruction. Access to education for women and lower-class groups has been extremely limited, although special governmental scholarships are in part redressing the balance. And as a paradox, in a country where illiteracy is the rule, there is a vast and growing group of high school and college graduates unable to find employment. Indians are aware of these and many other problems in education,

however, and they are working very hard to solve them.

Libraries and Museums.—Public libraries are operated under municipal or state auspices in most of the larger cities, and there are small libraries in many towns and villages. The largest collection is that of the National Library in Calcutta, which had more than 800,000 volumes in 1957. Many government departments maintain excellent libraries, as do the various universities and learned societies. In 1958 the Gandhi Memorial Foundation opened at Madurai the first of a series of Gandhi libraries.

Most of the museums in the country belong to the Museums Association of India, whose headquarters are in Bombay. Among the most important collections of art and archaeology are those in the National Museum of India, New Delhi; the Prince of Wales Museum of Western India, Bombay; the Government Museum and the National Art Gallery, Madras; the Rajputana Museum, Ajmer; the Baroda Museum and Picture Gallery, Baroda; the Archaeological Museum, Mathura; and the Indian Museum, Calcutta.

See also 18. *History: 1707-1947*; and separate articles on **EDUCATION**—2. *National Systems of Education* (India) and 8. *Higher Education* (Ancient World): India; **LIBRARIES**—2. *Modern Foreign Libraries* (India).

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7. ARCHITECTURE AND ART

Although the main sites of the most ancient art of the Indian subcontinent, that of the Harappa civilization (c. 2500-1700 B.C.), are situated in Pakistan, proto-Indian art was not confined to the Indus Valley but extended as far south as Lothal, near Ahmadabad, and as far east as Rupar, on the upper Sutlej River. The art of the 1st millennium B.C. down to the 3d century has survived only in stupas (Sanskrit *stūpa*), such as that at Kausambi, Uttar Pradesh; abstract copper-sheet figurines (Bisauli, Uttar Pradesh); the 25-mile-long fortifications of Rajgir, Bihar; and rock paintings in Raigarh, Madhya Pradesh.

3D CENTURY B.C.—4TH CENTURY A.D.

The continuous history of Indian art begins with the Maurya dynasty (321?-184 B.C.), whose rulers made Pataliputra (modern Patna) in Magadha, Bihar, the capital of an empire which extended in the northwest into Afghanistan and Persia. Both Pataliputra and the other large towns on the highways which brought Persian forms to India—Taxila, Ayodhya, Vidisa, and Ujjain—were built of perishable materials. Under Asoka (r. about 274-237 B.C.) the original wooden columns of the palace hall at Pataliputra were replaced by stone columns of Achaemenid design. A park laid out like the formal Mughul (Mogul) gardens 2,000 years later surrounded the palace.

Columns and Stupas.—Following the bloody conquest of Kalinga (modern Orissa) about 262 B.C., Asoka was converted to Buddhism. Thereafter, bent on peaceful conquest, he promulgated his principles of righteous government by having them engraved on rocks and columns. The characters of the inscriptions, which are incised with a precise beauty, are the first evidence of an Indian script (Brāhmī) after that of the proto-Indian seals. The monolithic, tapering shafts of the columns are embedded for about one third of their

height and are supported underground by brick platforms. Their equally monolithic capitals, of an inverted lotus shape, are fixed to the shaft by an inner copper bolt. In certain cases, as at Sarnath near Varanasi (Banaras), the capitals supported the wheel of the law, its spokes carved exquisitely in the round. Each column symbolized the cosmic pillar, holding heaven and earth apart, and signified ordered life under a righteous government. The carving of the capitals is related to that of Achaemenid Persia, in whose empire the Punjab had been included from the mid-6th to the late 4th century B.C.

Altogether different and indigenous in style is the elephant, dated in the ninth year of Asoka's reign, whose front half emerges from the vertically planed surface of a rock in Dhauli, Orissa. The animal is carved in basic shapes which suggest elephantine structure and movement, and its outline is assimilated to that of the hill in which its hind part is hidden.

Carving from the living rock is a technique that is also employed in sanctuaries of the Ājivika sect hollowed out of Barabar Hill near Gaya, Bihar. Their small, rectangular halls have highly polished walls and straight or vaulted ceilings. In two instances (Sudāmā and Lomas Rishi caves) a small circular or oval chamber is hollowed out behind the narrow end of the hall.

The *Bauddhāyana Dharmasūtra* (2: 2, 6, 33) says: "It is impossible for one who lives in a town to attain salvation." A turning away from town life, together with a desire for visual evidence of the everlasting truth of their religion, led monks of the reform movements of Jainism and Buddhism to excavate rock-cut temples and monasteries in the hills. The same desire prompted the adoption of stone for stupas and other religious structures.

Legend credits Asoka with having set up 84,000 stupas. Originally a stupa was a mound erected over the relics of a chieftain, earth being heaped around a central pillar. For Buddhists the stupa over the relics of the Buddha or those of his disciples was symbolic of the *parinirvāṇa*, the total decease through which the Buddha left the human body and assumed universal reality. In Asoka's time stupas were made of bricks piled in a solid dome shape, called *anda* (egg), rising over a circular plinth. They symbolized the cosmos under the dispensation of the law (*dharma*) of the Buddha. The stupas piled in Asoka's reign were subsequently enlarged by overmantling and were faced with stone slabs. (Asoka himself had the stupa at Nigliwa, Nepal, enlarged.)

Rock-Cut Temples and Monasteries.—The impact of the official art of the Mauryas, as represented by free-standing stone pillars, was felt as late as the 1st century A.D. (capitals of the South Gateway at Sanchi, Madhya Pradesh), although they are overwhelmed by the wealth of indigenous forms amid which they appear. The monumental art of the period from the 1st century B.C. to the 1st century A.D. was created mainly in the service of Buddhism. In the Western Ghats (Bhaja, Nasik, Kondane, Bedsa, and Ajanta) apsidal rock-cut temples reproduce structural buildings by means of monumental sculpture carved in the natural rock. Representations of contemporary wooden buildings are found in reliefs on the railings and gates of stupas and in paintings on the walls of caves. The buildings range from single-roomed, domed huts to multistoried mansions having open pillared halls on the ground floor, bal-

conies with railings along each of the upper stories, closely spaced arched window or door openings, and wagon-vaulted roofs with dormer windows. Sanctuaries either resembled these mansions or were laid out on a central plan. A special case is the tree temple of Bodhi (Buddh) Gaya, Bihar, whose galleries enclose, and whose dome was surmounted by, the bodhi ("bo") tree under which the Buddha attained enlightenment.

In Bairat, Rajasthan, exist the foundations of a structural, circular brick temple with wooden pillars (c. 3d to 1st century B.C.), which was similar to the pillared and domed circular temple with a vaulted ambulatory (1st century A.D.) cut out of the rock at Junnar, north of Poona in the Western Ghats. Also of the 1st century A.D. are the apsidal temples at Nasik and Bedsa called chaitya (Sanskrit *caitya*) halls, whose plan results from a contraction of the rectangular hall and circular sanctuary. The façade of these chaitya halls is dominated by a large circular window (*gavākṣa*) in the middle of the second story, while the small door opening in the middle of the ground floor is surmounted by a smaller, solid *gavākṣa* shape. In earlier rock-cut temples, such as that at Bhaja (1st century B.C.), the façade was pierced in the middle by a large arched opening closed by a wooden screen. Although this combination of timber construction and stone carving was abandoned, even in one of the last and the most magnificent of this series of rock-cut temples (Karli or Karle; early 2d century A.D.) arched wooden beams were attached to the vault of the apsidal hall. Light from the large *gavākṣa* falls on the rock-cut stupa, the main cult object, at the opposite end of the hall. Thick, closely set pillars divide the narrow aisles from the nave and extend behind the stupa, forming an ambulatory whose darkness makes the walls of the interior (124 by 45 by 45 feet) recede into the distance. The octagonal pillars of Karli, with their vase-shaped bases and faceted, lotiform capitals surmounted by inverted pyramids carrying sculpture groups, are far in advance of the thin, timberlike, sloping posts without base and capital of the earlier temples.

Rock-cut monasteries called viharas (Sanskrit *vihāra*) or *saṅghārāma* were given their perfected form in the 2d century A.D. at Nasik (Caves No. 10 and No. 3), where a pillared veranda leads to a large, square central hall with cells on three of its sides. This arrangement is an adaptation of a structural cloister with a square central court. In the two-storied Rāñi Gumphā Cave (c. 1st century A.D.) on Udayagiri Hill, near Khandgiri, Orissa, however, the cells are ranged on three sides of an open court.

Sculpture.—In the decoration of monuments sculpture served both as an illustration of doctrine and as an evocation of its meaning. Stupas and other sacred objects were surrounded by railings (*vedika*), to which gates (*torana*; Sanskrit *torāṇa*) were added. Stone versions of wooden fences, these railings have thick rectangular posts, crossbars, and coping stones, carved with rectangular, circular, or friezelike relief compositions or with large single figures. The low reliefs in Stupa No. 2 at Sanchi (c. 2d century B.C.) are symbolic configurations mainly of plant (lotus) and animal shapes with a few human figures. There are only a few narrative scenes. The closely set single shapes are flattened and laid out rhythmically on the surface. In contrast, the generally narrative panels from the railing and gate of the stupa of

Bharhut, Madhya Pradesh (c. 100 B.C.), are in a higher relief, the figures are as a rule more widely spaced, and the linear movement is more consciously organized and calm. The subjects illustrated are *Jātakas* (stories of the previous births of the Buddha). The reliefs on the square railing of Bodhi Gaya (1st century B.C.) further clarify the relation of figure and background. The inventiveness of the narrative relief on the gates of the Great Stupa at Sanchi is seen in the crowded grouping of its figures, mainly human, and in the effect of movement imparted by the light and shadow of its relatively high relief. Linear rhythms are no longer the main organizing factors. *Jātakas*, scenes from the life of the Buddha, and episodes from the history of Buddhism are of equal importance in suggesting the presence of the Buddha, who is not himself represented in any of the carvings.

Dating from this period (c. 1st century A.D.) also are colossal free-standing statues, representing yakshas (Sanskrit *yakṣa*), yakshis (Sanskrit *yakṣi*), and other pre-Buddhistic divinities, found in the Gangetic Valley and in central India. In these works naturalistic traits are given a static, cubical form. Two Jain images—one from Lohanipur, Bihar, possibly of earlier date, and the other a bronze figure of Pārshvanātha (Pārśvanātha) in the Prince of Wales Museum of Western India, Bombay—show the conventions which remained binding for Jain images of all periods, while the face of the bronze image forcefully portrays a visionary, ascetic type. A stone linga, or phallic symbol of Shiva (*Śiva*), in Gudimallam, Andhra Pradesh (c. 1st century A.D.), has an anthropomorphic image of the god in front. The low reliefs of the monastery in Bhaja (c. 1st century B.C.) are true rock sculpture spreading framelessly over the surface and continuing at a right angle on the adjacent surface. The quality of these traprock reliefs is purely plastic. The reliefs of the chaitya hall in Karli (early 2d century A.D.) owe as much to this west Indian mode of cave sculpture as to the north Indian school of Mathura, while the rock sculptures of eastern India (Udayagiri, Orissa) are related to the reliefs of the gates at Sanchi.

While the teeming torana reliefs of the Great Stupa at Sanchi were being carved in the 1st century A.D., the school of Mathura, under Kushana (Kuşāna) rule, evolved a sober style in which a few large figures were carved in graded relief planes. Anthropomorphic images of the Buddha and Bodhisattvas followed a change in Buddhist doctrine, answering a demand for images which another school in the Kushana Empire, that of Gandhara (Gandhāra) in what is now Pakistan, satisfied with the assistance of classical Western models. Mathura created a particular type of the Buddha image, a refined variety of its yaksha statues. The bodies of female figures, as in the yakshis of the Bhutesar railing, were modeled with sensuality. There is also a style of typological portraiture documented by examples and inscriptions. The statue of King Kanishka (Kanishka), for example, is a unique creation, combining indigenous modeling with planar discipline and trenchant outline. The wide-eyed heads of gray terra-cotta figurines from Mathura (c. 1st century A.D.) resemble the faces of Greek works between the archaic and classical periods.

In the 1st and 2d centuries A.D., the school of Amaravati (Amarāvati) in Andhra Pradesh decorated stupas with small-figured reliefs in grayish

white limestone, of which a few display the anthropomorphic Buddha image. Symbolic presentation and impassioned narrative are presented in a style of extreme elegance, whose sophistication transforms curvilinear movement and virtuoso modeling into expressions of the pathos of the fugitive festival of life. The style of Amaravati was in its formative stage in the 1st century and the beginning of the 2d century, when the reliefs of Jaggayapeta were being carved; reached its height in the middle of the 2d century; began to disintegrate at the end of the 2d century; and was continued in Nagarjunakonda (Nāgārjunakonda) in the 3d century and in Goli into the 4th century.

The monumental cave sculptures of Karli and the miniature reliefs of Amaravati were the great contributions of Indian sculpture of the period from the 3d century B.C. to the 2d century A.D. Sculpture in stone, however, comprised only a fraction of the plastic output. While none of the work in wood has survived, there is an abundance of terracotta figurines and plaques from the Ganges-Jumna Valley and elsewhere in northern India and the Deccan. These testify both to the essentially plastic quality of Indian sculpture and to the abstract and nearly unchanging religious art of the people. The only survivals of secular art are ivory plaques from Bagram, Afghanistan, whose style is related to that of Mathura and Amaravati and also exhibits a slight admixture of classical and Chinese elements.

Painting and Other Arts.—The art of painting was widely practiced in a gouache technique on a carefully prepared ground on cotton cloth, wooden boards, walls, and rock surfaces. Only some of the rock paintings still survive. The ceiling paintings of the Jogimārā Cave in the Ramgarh Hills of Orissa are related to the reliefs of Jaggayapeta, while the painted frieze on the left-hand wall of Cave No. 10, Ajanta, is closely connected with the Sanchi reliefs. All the resources of modeling in color, in line, and by shading were combined to produce a three-dimensional effect of plasticity.

The arts of the lapidary and the jeweler can be seen in the paintings, sculptures, and terracotta plaques of the period. Indigenous motifs were combined with Achaemenid and Scythian devices, and classical Western designs were used in Gandharan jewelry. Impressions of Western forms were also conveyed to India by coins and pottery (Roman coins and Arretine pottery, found at Arikamedu, Madras).

4TH TO 7TH CENTURY

Architecture.—Rock-cut sanctuaries, which had their small and simple beginnings in the 3d century B.C., attained their perfected form as Buddhist chaitya halls in the 2d century and as monasteries between the 5th and 6th centuries A.D. In these years about 1,200 cave sanctuaries came into existence. Except for approximately 100 Brahmanical caves and a few Jain excavations, they all served Buddhist worship and monasticism. Meanwhile, structural architecture in stone and brick began afresh in the 5th century, and before the 9th century had developed its principal types. Most of these buildings were Hindu temples. These new structural, stone-built sanctuaries were also adapted in rock-cut forms.

Buddhist Temples and Monasteries.—The form of the Buddhist rock-cut temple was perfected at Karli early in the 2d century A.D. In the following centuries it became a base for elaborate

sculpture. Carvings covered the triforium belt above the pillars; the wooden beams of the vault were copied in stone; and the stupa in the apse at the end of the hall gained in height and had a large image of the Buddha carved in front of it. The façade of Caves No. 19 and No. 26 at Ajanta (5th and 6th centuries, respectively) is still dominated by the central *gavākṣa*, but has a roll cornice above the first floor, while images of the Buddha take the place of the subordinate *gavākṣa*. In the last of the rock-cut chaitya halls, the Viśvakarmā Cave at Ellora (Elura; c. 7th century), the central *gavākṣa*, now of diminutive size, is relegated to the top of the second story of the façade, which is filled with large, rectangular windows as in a trabeate stone structure.

The viharas of this period far surpass the chaitya halls not only in number, but in development. They have a pillared porch in front of the hall, a regular row of monk's cells on the two sides, and, in the center of the far end, a small sanctuary flanked by one or two cells on either side. Whereas the earlier caves had no pillars, a colonnade runs on all four sides of the hall in the latest caves. (The earliest pillared cave, Ajanta No. 11, has only four pillars.) Ajanta Viharas No. 16 and No. 17 of the 5th century A.D. are excelled by Viharas No. 1 and No. 2, which were excavated about a century later. All four viharas have paintings on their walls, ceilings, and pillars. The pillars are surmounted by broad, fluted, amalaka (Sanskrit *āmalaka*, myrobalan) capitals.

Other Buddhist caves, such as those at Bagh, Madhya Pradesh (early 6th to early 7th century), add pillars of varied design in the center of the colonnade, while the viharas at Aurangabad, Bombay State (7th century), place the shrine conspicuously in the center of the hall. Two three-storied viharas in Ellora (Caves No. 11 and No. 12), with plain, square pillars on each story of their façade, have stately, sumptuous halls whose pillars are richly decorated with vase and foliage capitals.

One of the few structural monuments of Buddhism, the Dhamekh Stupa in Sarnath (c. 6th century), with its high plinth and drum, is remarkable for the richness of its abstract geometrical ornament alongside luxuriantly modeled lotus panels. Such contrasts in theme and sculptural execution, however, had been employed much earlier in Bharhut (c. 100 B.C.).

Hindu and Jain Temples.—Hinduism at first had no use for the large rock-cut interior, for it did not know congregational worship, nor did it in this period possess monastic orders. The first Hindu caves (early 5th century), in Udayagiri Hill near Bhilsa, Madhya Pradesh, are small, squarish shrines to which a structural stone porch has been added in front. Cave No. 3 in Badami (Bādāmi), Mysore (578 A.D.), follows the Buddhist example of having a pillared veranda, a hall, and a small sanctuary at the far end. Another cave at Badami is Jain (7th century). At Junagadh, Kathiawar, is an exquisite pillared hall whose use is unknown.

The apogee of Hindu cave temple design was attained in the 7th century at Ellora, where the walls of large halls are used for gigantic sculptures (Daśa Avatāra Cave). A small shrine with an ambulatory may be placed at the far end of the hall (Rāvaṇa kā Khāi and Rāmeśvara caves), or a transept may traverse the hall (Dhūmar Lenā Cave; c. 8th century). The most stupendous

of all the excavations is the spacious two-storied Kailāsa Temple (second half of the 8th century). Completely carved outside, it appears to rise between the vertical cliffs of its open-air ambulatory. A rock-cut version of the structured Kailāsanātha Temple in Kanchipuram, Madras (8th century), the Kailāsa Temple was itself repeated on a smaller scale in a Jain rock-cut temple, the Chhota Kailāsa of Ellora. Another masterly rock-cut temple is the unfinished Veṭṭuvānkoil, a Shiva temple at Kalugumalai, Madras (c. late 8th century). Of the same period are two large Jain temple halls, Indra Sabhā and Jagannātha Sabhā, Ellora.

The first structural stone temples are not impressive. The typical building is a small, square, flat-roofed shrine with a porch, either raised on a low plinth (Temple No. 17, Sanchi; 5th century) or surrounded by a covered ambulatory. It has either a small second story or a shrine on the second floor (Pārvaṭi Temple, Nachna Kuthara [Nacnā Kūṭhara], Madhya Pradesh, 5th century; Meguti Temple, Aihole, Mysore, 634 A.D.), or a small, more or less pyramidal, storied superstructure called a *sikhara* (Sanskrit *śikhara*; Daśa Avatāra Temple, Deogarh, and brick temple, Bhitargaon, Uttar Pradesh; c. 600 A.D.). Many varieties of these types are found in northern India and coexist in the southwestern Deccan. Two temples in particular, at Mahakut, Mysore (602 A.D.), represent early examples of the two main types of Indian temple architecture, the Nāgara or northern style and the Dravidian style. The Nāgara style, which is characterized by a curvilinear *sikhara*, is that of the majority of later Indian temples. The Dravidian style belongs to the south, and in one of its later, modified versions, called Vesara, to that part of Mysore where Mahakut is situated.

A few brick or stone temples (Ter, Bombay State; Chezarla, Andhra Pradesh; Durgā Temple, Aihole) are late examples of apsidal structures, whose design, developed originally to meet Buddhist needs, was adjusted to Hindu worship by dividing the sanctuary from the hall. A rock-cut version of this type is the Sahadeva Ratha in Mamallapuram (Mahabalipuram), Madras (first half of the 7th century), one of several small temples cut from granite in this part of the Pallava dynasty. These temples are miniature replicas of structural Dravidian temples. Except for the square Draupadi Temple with its square "dome," they simulate storied structures.

Sculpture.—Sculpture attained unequaled heights from the 4th to the 8th century. By means of subtly modeled planes and firm, flowing profiles, the Buddhist cult images of the 4th to the 6th century embody an inner spiritual realization. Iconographic formulas and facial traits are integrated in the plastic context, which is as sensitive as it is disciplined. Specific postures (*asana*; Sanskrit *āsana*), positions of the fingers and hands (*mudra*; Sanskrit *mudrā*), and supernatural signs (*lakṣaṇa*)—such as the cranial protuberance (*uṣṇīṣa*), elongated ears, webbed fingers, overlarge eyes behind lowered lids, and raised, arched brows conveying intensities of meditation, all of which indicate the more than human nature of the Buddha—serve as accents to stress the meaning of the overall plastic conception. Of the seated images of inwardly realized Buddhahood, that from Bodh Gaya (National Museum of India, New Delhi), which is assignable to the 4th century, is the earliest and most powerful. A

seated Buddha image from Sarnath (6th century), which shows the Buddha preaching his first sermon, has in its flawless balance a geometrical foundation of proportionate triangles and circles. In the latter respect, the image constitutes a *yantra*, a magical diagram in which the powers inherent in the deity are assigned to definite places in the design.

The Hindu sculpture of northern India, under Gupta rule, attained similar heights in the reliefs from Garhiwa near Allahabad, where the last residues of classical Western art are absorbed into a classical Indian art; in the stucco reliefs of the circular Nāga temple at Rajgir, Bihar; in the central Indian sculptures of Bhumara (6th century); and in the Daśa Avatāra Temple, Deogarh (c. 600). In their plastic sensibility these works give concrete form to subtle realizations of the path toward nirvana (Sanskrit *nirvāṇa*) or moksha (Sanskrit *mokṣa*).

In contrast, contemporary rock-cut sculptures of the Deccan embody the myths and potent presence of the great gods. The volume of the rocks adds its weight to the total impact of the sculptures, which have the timeless immediacy of cosmogonic powers. Superhuman in size and conception, the figures are based on an idea attainable only by perfect control of mind, emotions, and body through the discipline of yoga. Thus transformed in life, the figure of man is translated by art into a form adequate to the aims achieved through yoga. The body is conceived as a vessel filled by breath and kept in shape by the balance of inner rhythms which no external stimulus can deflect from their course. While this conception is also true of northern Indian sculpture, in the rock sculpture, particularly that of the Deccan, the figures also act out cosmic myths. They are the shapes of powers over life and death, whose deeds are performed in the stillness of withdrawal.

The northernmost and earliest outpost of gigantic mythical Hindu sculpture carved in the rock is the relief of the Varāha (boar) incarnation of Vishnu (*Viṣṇu*) on Udayagiri Hill, near Sanchi (beginning of the 5th century). Centuries lie between it and the ponderous compositions in the caves of Badami (578 A.D.), the eruptive power of the cave sculptures at Ellora (7th century), and the brooding satiation of those in Aurangabad (7th century). The greatest of all cave sculptures is the image of Mahādeva on Elephanta Island, near Bombay (c. 8th century), which is flanked by the majesty of other gigantic conceptions of the myth of Shiva. The Dhūmar Leṇā Cave in Ellora and the sculptures in Lonad are related to the style of Elephanta, while the sculptures of the Kailāsa Temple in Ellora (second half of the 8th century) have the svelte character of the south Indian idiom absorbed in the greater vision of Deccan cave sculpture.

The sharply defined quality of the rock-cut reliefs at Mamallapuram in south India (first half of the 7th century) is seen in the relation of architectural shapes and human figures; in the placement of the figures, some of them ideal "portraits," in large, rectangular panels; and in the adaptation of a mythical panorama to the entire surface of a rock. At the base of the relief called the *Kirātārjuniya* (*Penance of Arjuna*) was a pond which received water channeled through the grooves and projections dividing the composition. The sculpture of the relief was enhanced by the play of the water. When south Indian sculpture was brought into the Deccan in

the wake of political conquest in the 8th century, it imparted its own characteristics to the greater conceptions of the Deccan in rock-cut sculptures as well as in those which form part of structural temples (Virūpāksha Temple, Pattadakal, Mysore; after 740). The Deccan school of sculpture of the 7th and 8th centuries in turn made its influence felt to the north and the east (Sanchi, Rajim) at a time when the Gupta school had passed its zenith, and the local schools of Baroda, Gujarat, and Rajasthan had made their mark.

Painting.—The cave temples of the Deccan are also the repositories of classical Indian paintings (Ajanta Caves No. 9 and No. 10, beginning of the Christian era; Caves No. 16 and No. 17, c. 5th century; Caves No. 1 and No. 2, c. 6th century; Badami, 578; Bagh, early 7th century). These gouache paintings, mainly in earth colors, are laid out in panels that fill the walls or are continued from the one wall to another. The figures are crowded like those of a tapestry, and the paintings seem to project their contents toward the spectator. This illusion of the third dimension does not lead into depth. On the contrary, it releases the figures toward the spectator so that their impact is felt at the same time that their gestures and grouping relate them to the tapestry-like context in which they are linked by interlacing waves of movement.

A contemporary text, the *Viṣṇudharmottara*, describes the varieties of painting then practiced on walls, wooden panels, cloth, and other materials. Subject matter was both religious and worldly.

Minor Arts.—The subject matter of terracotta plaques, figures, and carved bricks of the 4th to the 7th century was as diversified as that of painting, and testifies to the use of these objects in both religious and residential buildings. Clay figurines and plaques were even more numerous, however, and the plasticity of Indian art owes much to the technique of modeling in clay. The high technical level of decorative art in these centuries is seen in the coins of the Gupta dynasty, in which classical Western and Kushana elements had become integrated.

HINDU ART: 7TH TO 15TH CENTURY

Architecture.—The development of Indian architecture from the 7th century on is concentrated in the Hindu temple built of stone or brick. Essentially, a Hindu temple consists of a sanctuary, generally square in plan, and its superstructure. Light falls through the door on the image of the deity or the linga of Shiva placed in the dark and small interior. While the thick walls of the interior are always unadorned, the outer walls of the sanctuary and the superstructure are elaborated in a variety of regional styles. The temple proper (*prāsāda* or *vimāna*; Sanskrit *vimāna*) with its small sanctuary (*garbhagṛha*) is the house and body of God. In front of the *prāsāda*, and placed coaxially with it, a porch and a hall (*mandapa*) or several halls may be added. Each of these has its own superstructure, which is lower than and different in shape from that of the *prāsāda*.

Nāgara Temples.—The leading temple type, the Nāgara, is found in all parts of India north of the Tungabhadra River. In a Nāgara temple a curvilinear superstructure (*sikhara*) rests on the four faceted walls of the sanctuary, and a broad buttress projects from the center of each of the three outer walls. While the interior is square,



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Above: Diwan-i-'Am, the hall of public audience, part of the Red Fort in Delhi.

Right: Intricately carved marble columns beautify the Dilwara temples at Mount Abu.

Vidyavrata/FLO

INDIA

Below: Relief sculpture is a prominent feature of the cave temples at Ellora.

Werner Bischof from Magnum



Kulwant Roy

Above: A gateway to the Great Stupa at Sanchi, carved in high relief.

Below: The Qutb Minār, an outstanding early Muslim monument, in Delhi.

Kulwant Roy



the exterior forms a stepped square or a stepped cross. The walls of the superstructure rise in parabolic curves from the sanctuary walls. The buttresses are continued along the curved slopes of the superstructure, which are gathered together toward the top. This truncated, curvilinear, trabeate superstructure terminates in a horizontal platform (*vedi*), surmounted in the center by a narrow circular neck that carries a flat, coggled stone (*amalaka*), which in turn is surmounted by a finial. The Nāgara type of temple, evolved in regional schools, was at its height from the 9th to the 12th century and continued into the 15th century, some of the latest examples being Jain sanctuaries in Rajasthan.

One of the earliest and simplest Nāgara temples is the Saṅgamaśvara Temple in Mahakut (c. 602); the Paraśurāmeśvara Temple in Bhubaneswar, Orissa (c. 7th century), temples in Osia, Rajasthan (c. 8th century), and the rock-cut temple in Masrur, Kangra District, Punjab (8th century) are variations of the same theme. In these shrines the sikhara and its buttresses are striated with stringcourses carved with miniature *garbhakṣas*, and its corners are punctuated at regular intervals by amalaka shapes. Rising from an indented cross of five, seven, or nine steps on each side, the central buttress is set apart by adjacent piers from the bulk of the building, whose carved facets rise tier upon tier in ascending planes.

Each of the three main regional schools of Nāgara architecture, those of Orissa, central India, and the northern Deccan, evolved a particular variety of sikhara and *mandapa*, while adaptations and subdivisions of these types are found in Rajasthan, Gujarat-Kathiawar, and the western Himalaya. Orissan architecture remained faithful to the original type as represented by the Paraśurāmeśvara Temple in Bhubaneswar. Where one or several *mandapas* are added in front of the *prāsāda* as places of rest and edification for pilgrims, the vertical and horizontal divisions of their walls correspond to those of the *prāsāda*. The superstructure of each hall is a low striated pyramid whose circular crowning members extend to an aliquot part of the height of the sikhara. The interior of these halls, which generally have no pillars, is lit dimly by latticed or perforated carved windows.

The number of facets of the superstructure increased from three in each direction in early Orissan temples to nine in later ones, and the total height from four (Paraśurāmeśvara Temple) to seven (Sun Temple, Konarak; 1238-1264) times the width. Each buttress is stepped in facets, so that the temple, from the plinth to the *vedi*, faces in all directions with its array of projections set off by the deep shadows of its recesses. The 9th century Mukteśvara Temple, Bhubaneswar, is the finest example of the Orissan style in its early maturity, while the Brahmeśvara and Liṅgarāja temples (c. 11th century) of the same city represent this style at its height. The sikhara of the Rājarañi Temple (11th to 12th century), however, is related to the central Indian style, while the Vaitāl Deul (8th century), with its wagon-vaulted tower, belongs to a widespread type represented mainly in the gate structures (*gopuram*) of south India. The wagon vault as well as the pyramidal tower characteristic of Dravidian architecture are found down to the 9th century also at various north Indian sites. Other Orissan shrines are built on a star-shaped plan, which in the 11th and 12th centuries was to become characteristic of

temples in the northwestern Deccan, but is found also at Nurpur in the Punjab. The regional specialization and logical development of a particular type are accompanied by anomalous types, which in turn may become the leading types of other regional schools.

In central India are found two distinct varieties of sikhara. On the first, which is similar to that of Orissa, the facets are extended beyond the *vedi*, which they surround with their pointed ends. The Mahādeva Temple, Nachna Kuthara (c. 8th century), is the earliest of this group, which comprises the temples of the Chedi and Chandella principalities. In Khajraho, capital of the Chandellas and a center of Nāgara architecture in the second half of the 10th and the 11th centuries, the other variety of the sikhara, of which the Kandariya Temple is the best example, was perfected. The sikhara here is actually a cluster of half and three-quarter sikharas, graded in height, which cling to its faces. The larger Khajraho shrines have an inner ambulatory with a wide, open, pillared balcony in the center of each face. The pillared hall in front of the temple is similarly open. High stone benches whose sloping backs project outward, their angle balanced by that of the projecting eaves above, frame the open spaces of the balconies. The *prāsāda* and its *mandapa* form a single architectural unit raised on a high terrace.

Sanctuaries built on a circular plan but otherwise conforming to the first variety of the Nāgara style are found in Uttar Pradesh in brick, having either a square *garbhagṛha* or a circular one, or in stone. The sikharas of temples in Rajasthan are of the clustered variety of the Nāgara style. Here an open pillared hall (*sabhā mandapa*) stands in front of the sanctuary with its hall. The white marble temples of south Rajasthan (Kumbharia; Dilwara, 11th to 13th century; Ranakpur, 15th century) have spacious pillared and domed trabeate halls.

Until about 1000 A.D., the temples of Gujarat and Kathiawar had either a pyramidal superstructure, as at Gop (6th century), or a Nāgara sikhara of the simpler type (temple near Thangadh or Than), and only rarely a sikhara of the clustered variety (Tarnetar), which later became the rule. With its open, pillared halls, ponds (Sun Temple, Modhera; 1026), wells, and gateways, the architecture of Gujarat and Kathiawar enhances the sumptuousness of the temples built on a star-shaped plan with an inner ambulatory and a two-storied *mandapa* (Ghumli; Sejakpur; Siddhapur).

The early Nāgara temples of the southern Deccan, with their curvilinear sikharas, rise alongside shrines with storied, pyramidal superstructures (Mahakut, Aihole, 6th to 7th century; Pattadakal, 8th century), while those in Alampur have Nāgara sikharas. The plan of all these temples, in which an inner ambulatory surrounds the sanctuary at the end of a rectangular pillared hall, is, however, typically south Indian.

In the northern Deccan a third variety of Nāgara sikhara combines offsets ascending in the four directions with horizontal, parallel arrays of miniature sikharas placed between the four piers (Nilakanthesvara Temple, Udayapur; 1059-1080). The plan is generally star shaped. Still other varieties are found in Bengal and in the western Himalaya.

Dravidian Temples.—In south India the Dravidian style develops in a straight line from

the monolithic raths (rathas) at Mamallapuram (first half of the 7th century) to its culmination in the Brihadiśvara (Brhadiśvara) Temple in Tanjore, Madras (c. 1010). The offsets of a Dravidian temple, which are relatively thin pilasters placed on a straight wall, do not extend to the superstructure, whose pyramid is articulated horizontally by false stories. On each story cells surround the walls of a central block. In the early temples an open-air ambulatory divides the cells or miniature shrines from the walls in the center, but beginning in the 8th century the rows of shrines, reduced in size and increased in number, cling to the body of the pyramid, which is crowned by a circular or polygonal dome shape surmounted by a finial. After the 11th century the pyramidal gate structures (gopuram) rise to a greater height than that of the sanctuary. Flat-roofed, open-pillared halls fill the temple precinct.

In the southern Deccan a mixed style of predominantly Dravidian elements, which was in process of formation from the 8th century on, reached its height in Mysore in the so-called Hoysala style with its star-shaped, many-shrined temples (Keśava Temple, Somnathpur; c. 1268). In all styles the door of the sanctuary is ritually and architecturally next in importance to the image in the *garbhagṛha*. The architectural and sculptural features of the door are enhanced by the porch in front of it and by its superstructure, which is attached to that of the *prāsāda* and connects it with that of the *maṇḍapa*.

Sculpture.—Sculpture is essentially part of the Hindu temple, which itself is monumental sculpture when viewed from the outside. The separately carved steles in the niches of the buttresses are cult images subject to iconographic rules, whereas the majority of the figures, carved almost in the round, and the relief compositions express the meaning and kinetic impact of the temple walls. While figure sculpture predominates on the perpendicular walls, the superstructure is enhanced by abstract architectural sculpture whose rhythmical sequences and graded scale correspond to the disposition of the figures of gods on the walls and plinth.

The schools of sculptures are even more diversified than the architectural styles; there are, for example, considerable differences between the Chandella and Chedi schools of central India. Iconographically, each figure and each motif have their definite place on the temple and their definite meaning. Artistically, the norm serves as the basis for subtle and infinite variations on the given themes. Besides temple sculptures in stone, brick, and wood (Brahmaur, Himachal Pradesh, c. 700; carved door, National Museum of India, New Delhi), metal statues of Buddhist divinities were cast with equal competence from the 3d century in Andhra Pradesh (Nagarjunakonda; Amaravati, 6th century); in central India (Srirpur, early 8th century); in Bihar (Nalanda, Kurkihar); and in south India (Negapatam, c. 9th to 16th century). The large Hindu images of Chamba, Himachal Pradesh (c. early 8th century), on the other hand, are surpassed only by those of south India. There, in addition to images of divinities, are found idealized portrait statues of saints and royalty not only in bronze, but also in stone on the temple walls (Nagesvaraśvāmi Temple, Kumbakonam, Madras; c. 9th century).

Painting.—In the ceiling paintings of the Kailāsa Temple, Ellora (late 8th century), the classical tradition of Ajanta was in process of

being superseded by an emphatic linear style of pointed angles and flat color surfaces. Beginning in the early 12th century the new linear style was to become the leading mode of Indian painting. Centered in the western part of the subcontinent, it was used pre-eminently in the illustration of Jain books made of palm leaves and, from the 15th century, of paper. By this time, Hindu and secular subjects were also painted as book illustrations and on scrolls (*Paśanta Vilāsa*, 1451; Freer Gallery of Art, Washington, D.C.). This style also spread to Uttar Pradesh (ceiling paintings of a Vaiṣṇava temple hall in Madanpur, 12th century; Jaunpur) and to central India (Mandu, Madhya Pradesh). Meanwhile, the classical tradition was continued in south India (wall paintings of the Brihadiśvara Temple, Tanjore; c. 1010) and in Bengal (Buddhist palm-leaf scriptures).

ART FOLLOWING THE MUSLIM IMPACT: 13TH TO 20TH CENTURY

Architecture.—The Muslim impact made itself felt in Indian art beginning in the 8th century, but only in the 13th century did a distinctive Indo-Muslim architecture develop. When the Muslim conquerors set up their mosques in Delhi (Quwwat-ul-Islām Mosque; 1195–1199) and Ajmer (c. 1205), they used the pillars of Hindu temples. Whereas the Hindu temple is centered on a cubical sanctuary housing the image or symbol of a god and achieves monumentality by means of its superstructure, the mosque, a pillared cloister whose west side indicates the direction of Mecca, is screened by a façade, and its central space is surmounted by a dome. The true arches of the façade and the squinch system supporting the dome are technically different from the trabeate indigenous construction, just as the spacious interior of the mosques and tombs, the contrast of flat walls without figure sculpture, and the volume of domes and minarets differ from Indian temple architecture.

The most outstanding early Muslim monument is the Qutb Minār in Delhi, a five-story tower of fluted red sandstone from which the faithful were called to prayer. The original four stories, each differing in section and in the bands of inscriptions surrounding it, rise in perfect proportion from a diameter of 46 feet at the base to one of 10 feet at the top. Carved inscriptions used as mural decorations also distinguish the tomb of Iltutmish (Altamsh; 1235), a king of the Slave dynasty. To the succeeding Khalji dynasty (1200–1320) the architecture of Delhi owes both the combined use of red sandstone and white marble and the keel-shaped arch. The buildings of the Tughluq dynasty (1320–1414), with their massed volumes of sloped, unornamented sandstone walls and marble Tatar domes (tomb of Ghiyas-ud-Din Tughluq), occasionally incorporate an Indian motif (amalaka; pot finial). The multitude of tombs erected in Delhi under the Sayyid (1414–1451) and Lodi (1451–1526) dynasties range from a cenotaph within an open pillared pavilion to cloister garths surrounding colonnaded octagonal or square monuments.

While successive dynasties left their mark on the architecture of Delhi, regional Indian styles made their contribution to the requirements of an alien cult and to the imported forms of its sanctuaries and civic buildings. After the tentative solution of the Jāmi' Masjid in Cambay (1325), the school of Gujarat created the unrivaled Jāmi'

Masjid of Ahmadabad (1423). The façade of the mosque, with its pillared portico flanked by airy screens and arches that contrast with the solidity of the buttresses and minarets, leads into a two-storied hypostyle hall of closely set pillars as in a temple *mandapa*. Later Ahmadabad mosques have closed façades with minarets on each side of the central archway or open façades with minarets at their ends. The perforated screens of the Sidi Sayyid Mosque (c. 1515) are unexcelled.

In Malwa, in what is now Madhya Pradesh, a local style based on the Tughluq and Lodi architecture of Delhi was used at Dhar and Mandu in the 15th century in religious and secular buildings with polychrome surfaces of stones and glazed tiles. Derived from these are the buildings of Chanderi, which, with the addition of Ahmadabad elements, in their turn influenced (and were surpassed by) the Hindu palaces of Bundelkhand.

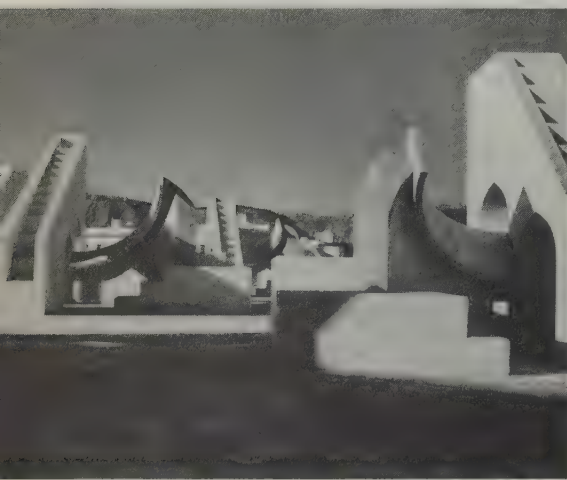
In the Deccan the Delhi style was reinforced by contemporary Persian elements, but the architecture of the courts of Gulbarga, Bidar, and Golconda cannot equal the Adil Shahi style of Bijapur, of which the Gol Gumbaz (mid-17th century) is the crowning achievement. Above its

mausoleum of Humayun in a parklike enclosure at Delhi (begun in 1564), an Indian interpretation of a Persian theme, antedates Emperor Akbar's fortress-palace in Agra (1566), which was based on the Hindu Man Singh's palace at Gwalior (c. 1500); and the new capital city, Fatehpur Sikri (founded 1569), with its Gate of Victory (Buland Darwaza; 1596) of the Jāmi' Masjid and its palaces of varied styles. During the reign of Emperor Jahangir, Akbar's mausoleum was completed in its garden setting in Sikandra (1613), and the white marble mausoleum of I'timād-ud-Daulā was inlaid with precious stones in its formal garden at Agra (1626). The latter has greater solidity than the dreamlike marble buildings of Shah Jahan (r. 1628–1658) in the Red Fort at Delhi, but it was that emperor who built the unrivaled Taj Mahal (Tāj Mahall) in Agra. The reign of Shah Jahan is also known for landscape architecture, which comprises both gardens without buildings, as in Srinagar, Kashmir (Shalimar, Nishat Bagh), and a combination of artificial lake and pavilion, in Ajmer, Rajasthan (Ana Sagar).

While Mughul architecture passed its zenith in the reign of Aurangzeb (Moti Masjid, Delhi; 1662), indigenous architecture contributed the carved brick temples of Bengal (Vishnupur; 16th to 18th century), the wooden buildings of Kerala, the Hindu palaces and stone houses of Rajasthan, and the carved wooden houses of Gujarat and the Punjab. Meanwhile, palaces erected in the south remained faithful to the south Indian tradition of storied pyramidal superstructures until, in the 18th and 19th centuries, Western influence produced not only architectural hybrids but also colonial buildings of quality. The British attempt of building New Delhi (inaugurated 1931) as a self-contained architectural unit was followed in the 1950's by the construction of Chandigarh, the new capital of the Punjab, by Le Corbusier and other foreign architects.

Sculpture.—The carved images of Hindu temple walls lost some of their importance under the rule of iconoclastic Islam, while new trends appeared within the traditions of Indian sculpture. In northern India the development of the linear style of painting described above preceded that of a school of sculpture in which the flowing sinuosities and subtleties of modeling were reduced to clear-cut masses laid out in angular planes. Except for the reliefs of the Hazara Rāma Temple in Vijayanagar (1514), south Indian stone sculpture of the period is of iconographic interest only. From now on painting displaced sculpture as the leading Indian art form.

Painting.—The western Indian school of painting had reached heights of refinement in the illumination of palm-leaf texts in the 14th century, and in the following century these were transferred to paper in glowing colors. The 16th century is of crucial importance in the history of Indian painting. The innumerable illustrations of Hindu myths, poems, musical modes (*rāga*), and other texts and the full-page album leaves that were the delight of princely and scholarly patrons for the next three centuries are seen in their initial stage, in which Persian (Shiraz), western Indian, and classical Indian styles are combined, in the *Nīmat-nāma* (Mandu; c. 1505). A similarly sprightly combination of styles enlivens the paintings of the *Tarīf-i-Hussain Shāhī* (Ahmadnagar; c. 1565–1570) and the *Nujum-al-'Ulūm* (Bijapur; c. 1570). Some of the zest of this



Werner Bischof from Magnum

Open-air observatory at Jaipur, built in the 18th century.

cubical walls rises a hemispherical dome with an external diameter of 144 feet, which spans one of the largest interiors in the world by means of a unique system of intersecting arches.

The builders of the mosques of Pandua (14th century) and Gaur (16th century) in Bengal utilized the carved black stones of Hindu architecture, while in Kashmir a local timber architecture (15th century) succeeded the earlier stone temples and was employed until the Mughul emperors introduced their own stone buildings. At Sasaram, Bihar, one of the greatest Indian Muslim buildings was erected about 1540 by Sher Shah, the Afghan king of Bengal and Delhi. This terraced mausoleum, which rises majestically from an artificial lake, honors the name of Sher Shah, as he had wished, "to the day of resurrection."

Like Sher Shah's mausoleum, the buildings of the Mughuls record patrons' aspirations in architectural terms. The red sandstone and marble

formative century appears also in south India in the wall paintings of Lepakshi (Vijayanagar school), while in north India a residual western Indian style formed the stem on which pre-Mughul Persian and Mughul elements were grafted. Thus richly nourished, new schools of charm and vitality developed in Rajasthan and central India. Painting under the Mughuls reflected the personality of the successive rulers. Persian, Indian, and European influences were combined in a school of miniature painting whose portraits are its noblest contribution.

Evolving independently from their pre-Mughul past, other Indian styles of painting were conceived on a larger scale than the miniatures of the Mughuls. Even though their actual format is generally that of an album page, the width of their spacing carries both epic and lyrical themes. The central Indian schools were the most important in the 16th century, and those of Rajasthan in the 17th and 18th centuries. Meanwhile, new schools developed at the western Himalayan courts following the disintegration of the Mughul court at Delhi. In such centers as Basohli in Kashmir and Kangra in the Punjab, a new vitality and profound religious experience were expressed in ever-fresh variations of style.

European influence produced the so-called East India Company paintings of Patna (18th to 20th century) and the popular bazaar style of Kalighat (Calcutta; mid-19th to early 20th century), and an infinitely varied folk art formed the background for painting as practiced in the Westernized cities of Calcutta, Bombay, Delhi, and Madras. In the 20th century three painters—Abanindranath Tagore (1871–1951), Jamini Roy (1887–), and Mohan B. Samant (1926–)—may be considered typical of the development of modern Indian painting in its conscious looking back to Indian tradition combined with the integration of contemporary Western styles.

Minor Arts.—The crafts, especially those of textile and jewelry design, responded to the stimuli of Mughul court life. In the 20th century, however, they were affected by the changes of the machine age.

See also 16. *Prehistory*; and separate articles on AJANTA and other sites of Indian art; ARCHITECTURE—India; BRONZE AND BRASS in ART—India; IVORIES—*Oriental Ivories*; JEWELRY—*The Orient*; LANDSCAPE ARCHITECTURE—*Development of Landscape Styles*; MOHAMMEDAN ART; NUMISMATICS—*Oriental Coins*; PAINTING—*Eastern Art* (Indian Painting); PAKISTAN—7. *Architecture and Art*; RUGS, ORIENTAL—*Egypt, Turkey, India*.

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8. DANCE, MUSIC, AND DRAMA

The arts of the dance, music, and drama have always been interrelated in India. Dancing and music share a common literature and a common term, *sangita*, and both are integral parts of the traditional drama.

Dance.—The dance was known in ancient India chiefly in a religious environment or as expressing religious themes, and even in the modern revival of Indian dancing the themes are largely those of religion. Among the artifacts of the Harappa civilization in the Indus Valley (c. 2500–1700 B.C.) is a bronze figurine of a female dancer. In the Rig Veda (*Ṛgveda*) the

goddess Uṣas (Dawn) is described as a brightly attired danseuse (RV 1: 92, 4). The Hindu epics *Mahābhārata* and *Rāmāyaṇa* and Buddhist literature show that not only was the art popular, but its chief exponent, the courtesan, was part of contemporary society and court life. The dramatist Kālidāsa was thoroughly acquainted with the technique of the dance, which is an important motif in one of his plays. In the Indian view, drama cannot be divorced from the dance, and the earliest treatise on the former, the *Nāṭya-śāstra* of Bharata, is also the basic authority for the latter.

In his work, Bharata describes two types of dance: the graceful, lyrical type called *lāsya*, and the forceful type called *tāṇḍava*. The *lāsya*, which is presented by a single danseuse, consists of 10 or 12 detached emotional themes. The *tāṇḍava* comprises 108 *karanas*, poses associated with the god Shiva (*Śiva*), each of which is determined by a particular disposition of the hands and feet. A selection of 2, 3, 4, or more *karanas* in a particular sequence is a dance composition called an *aṅghārā*. Such dances, significant only for the beauty of their motion, are known as *nṛtta*; a dance which portrays and interprets human emotion is called *nṛtya*.

While rhythmic movement and the expression of emotions or ideas are found in the dances of all countries, in the Indian dance the steps and the motion of the limbs follow specific *tālas* or rhythmic measures, which are improvised into varied patterns and tempos worked into different designs with crescendo endings. Moreover, the expression of emotions and ideas is presented through large physical movements (*aṅgika*); subtle facial expressions (*upāṅga* or *mukhaja*); and hand symbols, called *hastābhinaya* or *mudra* (Sanskrit *mudrā*), which interpret, word by word, the meaning of a song or poem.

The greatest early writer on the dance after Bharata was Kohala, who codified many minor forms not noted by the former. Expositions of Bharata's text were written by Śrīharṣa, by a Buddhist named Rāhula, and, between the 9th and 11th centuries, by a number of savants in Kashmir. At this time the tradition of the dance was also actively cultivated in Malwa, where King Bhoja of Dhar was the most important writer; and in Mithila (northern Bihar), where Nānyadeva composed a lengthy commentary (*bhāṣya*) on Bharata. Western India then embraced the subject, and rulers of the Chalukya and Yadava dynasties and writers patronized by them contributed excellent expositions of the art. In Andhra, Jāyasaṃpati wrote a very useful work, *Nṛttaratnāvalī*. The center shifted in the 17th and 18th centuries to Tanjore, where south Indian music and dance reached its highest development. In Kerala dance dramas served to keep the art alive. Meanwhile, the dance continued to be fostered in the north, particularly in Mewar, Bihar, Bengal, Assam, and Orissa, where a number of valuable treatises were written. There are also texts ascribed to gods and sages, of which the most important is the *Abhinayadarpaṇa* (*Mirror of Gesture*) of Nandikeśvara, used in all parts of south India. Among materials in regional languages, those contained in the Tamil epic *Siḷappatikāram* (*Lay of the Anklet*) and its commentary by Adiyārkkunallār are the most noteworthy. Sources for the study and reconstruction of the Indian dance do not lie only in such books: even greater aid is to be had from painting and

sculpture, as in the Amaravati Stupa and the temples of Chidambaram and Tanjore. Of still greater value is the living tradition of the Indian dance in Southeast Asia, where much that has been lost in India itself can be recovered.

From these and other sources we know of a number of forms and compositions. The *lāsya* continued to be the solo feminine dance par excellence, now represented by the south Indian nautch. In addition, a form with a continuous story was composed for solo dancing and gesticulation. Other forms are known from the plays, from the commentary on the *Nāṭyaśāstra*, and from Bhoja's *Sṛṅgāra Prakāśa*. In most of these a love theme is interpreted by one or more dancers. Some of them (for example, the *prasthāna*) employ intricate dances; some, such as the *ḍombī*, use such special instruments as a miniature drum; and some, among them the *bhāna*, display the gaits of different animals. The *rāsaka* comprises a variety of designs composed by two or more dancers. There are also many regional dances described in later works. Among these are the *gondālī*, taken from the hunters of Maharashtra. The *kollāṭa* is an acrobatic dance. The *kandukanṛtta* employs a ball. The *cindu* is a Dravidian dance mode, and the *jakkani* originated in Iran. The *śābaranṛtta* is a hunter's dance, the *kuranvañci* is a gypsy dance, and the *karakam* is a religious dance performed with a pot on the head. As the art developed, fresh movements and poses were adopted from different regions (*deśī*). Among the new regional elements were many jumps (*utplutī*), which were not previously known.

In modern India the art of the dance lives in the following principal forms: the nautch or *Bharata nāṭya* of the south, chiefly Madras; the *kathakālī* of Kerala; the *kathak* of the north; and the *manipūrī* of Assam. The nautch and the *kathak* are related lyrical solo dances. The former has Andhra, Kannada, and Tamil styles, the last now being popular in all parts of India. Dominating all forms is the 12th century masterpiece of Jayadeva, the *Gītagovinda*, which inspired many of the regional types of dance.

In most solo dances the emotion portrayed is love centering around a god, often Krishna (*Kṛṣṇa*); such love implies the spiritual yearning of the individual soul for the Supreme Soul. Devotional cults (*Bhakti*) in various areas have proved an inspiring force of the art.

See also separate article on DANCE—*Historical Beginnings*.

Music.—The earliest form of Indian music is found in the *Sāma Veda*, a musical treatment of the hymns of the *Rig Veda*. A special priest, the *udgātṛ*, sang the hymns at the sacrificial ceremonies, and they were also sung as mystic exercises believed to bestow spiritual benefit on the singer. This religious theme is a basic characteristic of Indian music, and throughout its history its greatest exponents have been saints.

The *sāman* (chant) was sung in a descending series of notes. In the beginning only three or four notes were employed; later the fifth, sixth, and seventh notes also were used, but the two last occur very rarely. According to the oldest theoretical authority, the *Nāradaśikṣā*, the *sāman* takes the secular flute notes in the order *ma* (*madhyama*), *ga* (*gāndharva*), *ri* (*ṛṣabha* or *riśabha*), *sa* (*śaḍja* or *śaḍja*), *dha* (*dhaivata*), *ni* (*niśāda* or *niśāda*), *pa* (*pañcama*). Vedic literature refers also to a large number of musical instruments, including stringed instru-

ments, flutes, cymbals, drums, and, most important of all, the *vina* (Sanskrit *vinā*, lute).

The second stage of Indian music is marked by heroic lays and epics—*akhyānas* (Sanskrit *ākhyāna*) and *itihāsas*—which minstrels (*sūtas*) recited to the *vina*. The third stage is represented by the sacred *mārga* or *gāndharva* music, which represented songs on Shiva sung to melodic patterns or scales called *jātis*. From the seven *svaras* (notes) three basic groupings called *grāmas* were formed. The high-pitched *ga-grāma* went out of vogue very early, and all the *jātis* in which the epics and early *mārga* songs were sung were derived from *ma* and *sa*. Later *ma-grāma* also declined, and all the melodies of modern Indian music are derived from *sa-grāma*. Out of the *jātis* developed the *rāgas*, the later large body of melodies characteristic of Indian popular music.

The first elaborate treatise extant is the *Nāṭyaśāstra*, in which music is described as an accessory of the dance and drama. Among the topics discussed are instruments, the melodic system, the 22 *srutis* (Sanskrit *śruti*, microtonal interval), the *ma-* and *sa-grāmas*, the 18 *jātis* (7 from each *grāma* and 4 mixed ones), the appropriateness of various notes and *jātis* for different emotions, and the songs (*dhruvās*) used in different situations. The most important later text is Mātanga's *Bṛhaddeśī*, which is the first to classify the *rāgas*.

The most noteworthy factor in the later history of Indian music is the growing distinction between the north Indian and south Indian schools (now known as Hindustani and Carnatic, respectively), which began in the Muslim period. While the fundamentals remained the same in both schools, stylistic differences developed. Moreover, the southern school assimilated features of the art characteristic of south India from the earliest times, some conception of which may be gleaned from the epic *Silappatikāram* and the Shaiva and Vaishnava psalms associated with south Indian temples. Since the south was comparatively free from outside influences, the southern school preserved the art in a purer form, although it is clear that the northern school preserved certain other aspects of the tradition. In general, the northern school permits greater freedom, and the southern observes stricter standards, in expounding the *rāgas*.

In contrast to Western music, which is harmonic, Indian music is melodic and depends for its appeal on a linear succession of notes. A note in Indian music is not a fixed point, however, but lies somewhere within an interval. The Indian singer does not hit a note exactly, but often approaches it with grace (*gamakā*), glancing or hitting another note slightly. The term *rāga* or *rakti*, which is used for melody or melodic sweetness, has an emotional connotation. The *rāga* system is notable not only for its variety and richness, but also for the play of imagination and improvisation developed in expounding the *rāga* within its accepted outline. A *rāga* can be expounded through a literary composition or by itself (*ālāpa*); in the latter method, in particular, it develops a poignant quality and has been valued for the mental concentration and spiritual absorption it induces. Since a *rāga* is to be understood in relation to a constant basic tonic (*sruti*), all Indian music is sung with a drone. Other distinguishing characteristics of Indian music are its rhythmic variety, which is derived from a system of 108 different *tālas*; and its many instruments.

Of special significance among Indian musical compositions at the end of the classical age is the *rāga kāvya*, a continuous poem sung in one or more *rāgas*; it is to this class that the *Gitagovinda* belongs. Under the influence of this work a number of musical poems and plays were created in various parts of India. There were also a large number of compositions called *prabandhas*, which employed either Sanskrit or the regional languages.

Following the development of northern and southern schools, distinctive forms of compositions arose in each area. The *dhruvād* is the most dignified and austere composition of the north; others include the *dharmar-hori*, *kheyāl*, *thumri*, *tappa*, and *tarana*. In addition, there is a vast body of northern devotional songs (*bhājans*). Among the basic composition forms of the south are the *lakṣaṇagita*, a grammatical composition for practice; *varṇa*, of both grammatical and artistic value; *kīrtana* and *kṛtī*, which are purely artistic; *paḍas*, both devotional and erotic; *jāvalis*, light love compositions; and *tillānas*, rhythmic pieces. These are in the Telugu, Sanskrit, Tamil, Kannada, and Malayalam languages.

See also separate article on MUSICAL INSTRUMENTS.

Drama.—Sanskrit drama must have been well developed by about 500 B.C., for the great grammarian Pāṇini refers to two aphoristic texts of acting, the *Naṭasūtras*. The minister-poet Subandhu, who lived at the court of the Mauryas in the late 4th and early 3d centuries B.C., wrote a play, the *Vāsavadattā Nāṭyadhārā*, a fragment of which survives in quotation. In a series of acts within acts he combined a court intrigue with the romance of King Udayana. The technique employed here shows that various forms of drama had developed before Subandhu's time. The celebrated Bhāsa was probably the leading dramatist before Subandhu. In the plays discovered in 1910 and ascribed (controversially) to Bhāsa, tense situations are developed in a simple technique and language. The best of them is the *Svapnavāsavadattā* (*Vāsavadattā Seen in a Dream*), based on the Udayana story. Evidence of a flourishing theater in the 2d century B.C. is found in the *Mahābhāṣya* of the grammarian Patanjali. The discovery of fragments of the play *Sārīputraprakaraṇa* by the Buddhist poet Aśvaghoṣa among the Buddhist manuscript remains in Turfan points to the same conclusion.

The outstanding Sanskrit dramatist was Kālidāsa (fl. 5th century A.D.), who wrote three plays. *Mālavikāgnimitra*, a play of the graft type called *nāṭikā*, tells the story of the love of King Agnimitra and Princess Mālavikā, who lives incognito in his harem as a gifted dancer. In the *Vikramorvaśīya* (*Urvaśī Won by Valor*) there is an unrivaled scene in which the hero raves in a forest after his beloved has disappeared. Kālidāsa's masterpiece, as indeed of all Sanskrit literature, is the *Abhijñānaśākuntala* or *Sakuntalā*, whose contrast of sylvan settings with court life and delineation of character and sentiment are superb. Nature and the human heart are unified by the poet, who also develops an underlying philosophy of love.

The outstanding example of a social play (*prakaraṇa*) is the *Mṛcchakaṭika* (*The Little Clay Cart*) by King Śūdraka (Śūdraka) of uncertain date. Acute characterization, a combination of realism and idealism, and much genuine humor make it highly stageworthy. A poet sometimes

likened to Kālidāsa, particularly as a master of pathos, is Bhavabhūti, who lived about 700 A.D. His *Uttararāmacarita*, depicting the later life of Rāma, touches the heart with its pathetic scenes. A successful play on the same theme is the *Kundamālā* (*The Jasmine Garland*) of King Dhiraṇāga. Bhavabhūti's *Mālatīmādhava* is a partially successful play of the type of the *Mṛcchakaṭika*. King Harsha (Harshavardhana) of Kanauj (r. 606–647 A.D.) was the author of three plays: the *Priyadarśikā* and the *Ratnāvalī*, of the same type as the *Mālavikāgnimitra*; and the *Nāgānanda*, which broke new ground by depicting as its chief theme the self-sacrifice of the hero in saving the life of a serpent (*nāga*). Another prince, Viśākhadatta, wrote two remarkable plays, one on a purely political theme called the *Mudrārākṣasa*, which employs friendship as an important motif; and the other, a political play turning on love, the *Devicandragupta*. Meanwhile, Sanskrit drama was cultivated in south India by King Mahendravarikrama Pallava of Kanchi, who wrote two farces: the *Mattavilāsa*, making fun of heretical sects; and the enjoyable *Bhagavadaj-jukīya*.

Like the *Rāmāyaṇa*, the *Mahābhārata* inspired many plays, including the *Mukāṭāḍika* of Bāṇa, the *Pārthaviyaya* of Trilocana, the *Pāṇḍavānanda*, and the *Venīsaṃhāra* of Bhaṭṭa Nārāyaṇa. Bhimaṭa, a Kālajāra prince, wrote five plays, of which the best, the *Svapnadaśanana*, is related to the *Rāmāyaṇa*, and the *Manoramāvatsarāja* exploits the Udayana cycle. By far the best of these plays yet to be discovered is the *Puṣpadūṣitaka*, a masterly social drama. Among other notable authors of heroic plays are Murāri, known for his *Anargharāghava*; Rājasekhara (fl. early 10th century), whose *Karapūramaijari* (*The Camphor Garland*), a play of love, music, and dance, was written entirely in Prakrit; Śaktibhadra, author of *Ācāryacūdāmaṇi*, and Kulasekhara, author of *Subhadrādhanañjaya*, both of the south; Kṣeṃśvara (fl. 10th century), who wrote *Caṇḍakaṇṭhika* and *Naiṣadhañanda*; and Jayadeva (fl. 12th century), author of *Prasannaṛāghava*. Other types of plays are *bhāṇa*, monologues of love and city life; and allegories representing different schools of thought. In the postclassical period, when minor courts in various parts of India actively fostered Sanskrit, there appeared many specimens of the shorter farce, amorous monologue, and heroic encounter, as well as plays on the lives of saints, local rulers, and temple legends.

The Indian technique of production is idealistic and symbolical and sets little store by extraneous stage settings. The earliest Sanskrit text on the theory of drama is the *Nāṭyaśāstra*, which covers the entire art of the theater, including proper buildings, make-up, language, prosody, poetry, plot and its construction, characters, speech and styles of acting, stage conventions, dance, and music. Drama (*nāṭya* or *rūpaka*) is defined as imitation (*anukāra*) or representation (*anukīrtana*). Three types of playhouse—rectangular, square, and triangular—are described, and 10 major types of drama and a derivative type are discussed: the heroic *nāṭaka*, the social *prakaraṇa*, a graft of the first two types (*nāṭikā*), the farce *prahasana*, the amorous monologue *bhāṇa*, the heroic encounter *vyāyoga*, the heroic *ḍima*, *samavakāra*, and *aṅka*, and the social *vīṭhi*. Plot is to be conceived in five stages (opening, progression, development, pause, conclusion), which

are brought about by the simultaneous development of the five elements of the story (seed, continuity or recurrent motif, major and minor helpful episodes, purpose) and the five stages of the action (beginning, effort, hope, certainty, fruition). Both plot and character are subservient to emotion, for the distinguishing mark of Indian drama is the theory of *rasa*, or the evocation of an emotional response in the spectators, who thereby attain serenity and repose (*vīśrānti*).

As time passed, music and dance became more prominent elements in the drama, and folk dances also inspired classical authors. These two trends enlarged the repertoire of the Indian stage with a score of new forms in operatic, dance-drama style, which were codified and described as *uparūpakas* (minor stage forms). The *uparūpakas* linked the classical and the popular theater, which developed in regional languages and gained fresh momentum from the Bhakti movements: the *yātrās* of Bengal; the *āṅkīa nāts* of the Vaishnava centers of Assam; plays of Bihar and Nepal mixing Sanskrit and local languages; the *bhāvai* of Gujarat; the *lālita* of Maharashtra; the *yak-ṣagāna* and *bhāgavata nāṭakas* of the Telugu, Kannada, and Tamil regions; and the *kṛṣṇāṭṭam* and the *kathakali* of Kerala.

With the advent of British rule and the establishment of English colleges and the universities, the realistic English stage was adopted in India. For a time there was vehement criticism of the indigenous technique, but with the support of Rabindranath Tagore, Indian authors soon woke to the beauty and value of the traditional theater, which attained a new vogue. In the 20th century both types of theater have flourished. Private efforts have been supplemented by those of the Indian government, which in 1952 founded the National Academy of Dance, Drama and Music.

See also 11. *Literature*; and separate articles on DRAMA—Indian Drama; ORIENTAL THEATER—India; PRAKRIT LANGUAGES AND LITERATURE; SAKUNTALA; SANSKRIT LITERATURE.

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9. LANGUAGES

Subcontinent of India.—The Indian subcontinent—politically divided since 1947 into the nation states of India and Pakistan—harbors, according to the last fully utilizable linguistic census (that of 1931), 141 different languages. As of 1951 censuses, these were spoken by a population of 438 million. Of the total, 78 languages have less than 20,000 speakers each (12 of these, less than 1,000). Only 26 languages can boast of more than half a million speakers. The rest, 115 languages, are distributed over not quite 2 per cent of the population, most of them being border infiltrations. Occasionally they constitute delicacies for linguistic specialists (such as the mysterious Burushaski, spoken in northern Kashmir by about 26,000 persons, which seems to be isolated among the languages of the world), but politically, economically, and culturally they have no more significance than the scores of American Indian languages spoken in the United States. The linguistic diversity of the subcontinent appears not greater but smaller than that of Europe, which is approximately comparable in area and population. According to the census of 1931, there were only four language families of more than 1 million speakers each: Indo-Aryan languages, 254 million; Dravidian languages, 72 million; Munda

languages, 5 million; and Iranian and Dardic languages, 4 million.

Indo-Aryan languages are spoken throughout the northern and central parts of the subcontinent as far as the Deccan. They extend farthest south in the west, the southernmost dialect being Konkani (belonging to Marathi), which is spoken on the west coast even below Goa. All these languages descend from a single language (divided early into a western and an eastern dialect), of which we have the earliest literary form (2d millennium B.C.) in the Sanskrit of the Rig Veda (*Rgveda*); transitional stages are given in the Middle Indic dialects (Pali, Prakrit, Apabhramsa). Genealogically, Sanskrit is closely related to Old Iranian (Avestic, Old Persian) and, together with it, forms part of the Indo-European family of languages.

Iranian languages are spoken in Baluchistan and along the northwestern frontier. The Dardic languages, spoken in Kashmir and Afghanistan, form a transitional stage between Indo-Aryan and Iranian.

Dravidian languages occupy the territory south of the Indo-Aryan languages and are found also in some enclaves within their domain, particularly in the eastern part of northern India. An exception is presented by Brahui (218,000 speakers), which is spoken in the farthest northwest within the area of Baluchi. This language is of the greatest historical interest, for its situation seems to show that an original continuum of Dravidian languages was broken up either by migration or by intruding foreigners (possibly the Indo-Aryans). The Dravidian language family cannot be connected genealogically with any language outside the subcontinent.

The Munda languages are scattered as enclaves in the southeastern area of Indo-Aryan speech. Together with the language of the Nicobar Islands, they may belong to the Mon-Khmer (Austroasiatic) language group.

Republic of India.—The Indian Constitution of 1950 made Hindi the official language of the republic, after 15 years to replace English, which was retained temporarily as an administrative vehicle. In addition to Sanskrit, which is the native language of no one but is mastered and spoken by a considerable number of scholars, and Urdu, which is a special literary form of Hindi, it named the following 12 main languages: Assamese, Bengali, Gujarati, Hindi, Kannada (Kanarese), Kashmiri, Malayalam, Marathi, Oriya, Panjabi (Punjabi), Tamil, and Telugu. Of the 26 languages with over half a million speakers, this enumeration excluded (1) 4 languages spoken only in Pakistan—Lahnda, Sindhi, Pushto (Pash-to), and Baluchi (Balochi); and (2) such languages as either have less than 1.5 million speakers or, like Bihari, lack a literary culture.

The accompanying table enumerates the 22 languages of more than half a million speakers as given in the census of 1931. Owing to the rather rapid growth of the population, later figures would be much higher. Where dependable figures are available from the 1951 census, they are added in parentheses.¹ Since the Pakistan border cuts through the area of Panjabi in the west

¹ As noted in the Census of India, Paper No. 1, 1954, *Languages—1951 Census*, pp. 1-2, falsification of some returns made it impossible to give overall figures for certain major languages, such as Hindi. Moreover, a different system of tabulating languages and dialects prevented the comparison of other figures with the returns of the 1931 and earlier censuses.

and that of Bengali in the east, the figures for these two languages include many speakers in Pakistan.

MAJOR LANGUAGES OF INDIA

Language	Major area in which it is spoken	Number of speakers (millions) ¹
<i>Indo-Aryan</i>		
Kashmiri (a Dardic language)	Kashmir	1.5
Punjabi (Punjabi)	Punjab	16 ²
Rajasthani	Rajasthan	14
Pahari (including Nepali)	Himalayan slopes	2.3
Western Hindi	Uttar Pradesh	71.4
Eastern Hindi	Uttar Pradesh	7.9
Bihari	Bihar	28
Bengali	Bengal	53.5 ²
Assamese	Assam	2
Oriya	Orissa	11.2 (13.1)
Gujarati	Bombay	11 (16)
Bhili	Rajasthan, Bombay, Madhya Pradesh	2.2
Marathi	Bombay	21 (27)
<i>Dravidian</i>		
Kannada (Kanarese)	Mysore	11.2 (14.5)
Malayalam	Kerala	9.1 (13.4)
Telugu	Andhra Pradesh	26.4 (33)
Tamil	Madras	20.4 (26.5)
Gondi	...	1.8
Kurukh (Oraon)	...	1
Kandhi (Kui)	...	0.6
Tulu	...	0.6 (0.8)
<i>Munda</i>		
Kherwari	...	4

¹ 1931 census; dependable 1951 figures in parentheses.

² Includes Pakistan. While the division of Punjabi speakers between India and Pakistan is not ascertainable, there were approximately 41.2 million Bengali speakers in East Pakistan in 1951. ³ Enclave within the Indo-Aryan area in central India. ⁴ District centering around the point where the borders of Bengal, Bihar, and Orissa meet.

Most of the Indo-Aryan languages are used for literary purposes. While Bengali can claim to have produced some of the most original and valuable literature, Hindi has spread farthest across the borders of its homeland—partly as a language of administration; partly as a literary language, used by educated speakers also in daily life (it is the language of instruction at Osmania University, Hyderabad, the first institution of higher education to give up English); and partly as a popular lingua franca, the so-called bazaar Hindustani, widely understood and handled, though in an ungrammatical, simplified form, by uneducated people and Europeans.

A form of Hindi was the official language of the Mughal (Mogul) rulers of India, whose Persian-Arabic culture had a momentous effect on its vocabulary (and, through its intermediation, on that of other Indian languages). It was from the administrative centers of the Mughuls that Hindi spread. The Western Hindi of the capitals (first Agra, then Delhi) was considered as exemplary. This particular form of language, written in Persian script and deeply influenced by Persian also as to literary models, was called Hindustani (language of Hindustan—that is, India) and, more specifically, Urdu (literally, [language of] the camp [of the Mughul rulers and their army]). In reaction to this Persianized Urdu, a purer Hindi was developed as a modern literary language, written in Hindi, that is, a simplified form of Devanagari, a northern Sanskrit alphabet from which the scripts of the other Indo-Aryan languages also are derived. Since India became independent in 1947, there has been a widespread tendency to purge Hindi still further by eliminating loan words from Persian and English and to fill the gaps with loans from Sanskrit.

Among the Dravidian languages, Kannada, Telugu, Tamil, and Malayalam (which only in the 10th century branched off from Tamil) have an old and rich literature. Smaller specimens of the Munda languages are Santali, spoken east of Kherwari; and Kurku, spoken in central India.

Language Problems of India.—By the late 1950's many of the primitive tribes of the Republic of India had given up or were about to give up their own languages in favor of one of the great Indo-Aryan or Dravidian languages. Meanwhile, Sanskrit, as the learned language of educated Hindus, continued to play a significant role in enriching the vocabulary of the living languages.

The introduction of Hindi as the official language and the intended abolition of the use of English for purposes of administration and academic instruction have created serious problems. Though bilingualism, even among the less highly educated, is much more common and usual in urban India than in the West, the use of Hindi as a second language has been opposed for reasons of cultural prestige in the Dravidian south and also in Indo-Aryan districts of a peculiar national culture (for example, in Bengal). The total elimination of English would cut off India from considerable advantages in international, economic, and cultural relations. Only a small percentage of the population (estimated at 5 million persons in the late 1950's) has mastered English, but it is politically, economically, and culturally the leading group. Much of the political, scientific, and technical terminology is English and difficult to replace by native expressions. The linguistic problem has been one of the most controversial topics of debate among Indians, especially as an item of educational policy. Justified sentiments of national pride and practical exigencies are often in bitter conflict, whether the problem is being considered in terms of Hindi versus national languages or of English versus indigenous speech.

See also 6. *Education* and 11. *Literature*; and separate articles on *DRAVIDIAN*; *SANSKRIT*; major living Indian languages.

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10. LINGUISTIC SCIENCE

Linguistic science is a field in which India held a unique position in the ancient world. Its discovery by Europeans at the end of the 18th century led to the development of modern linguistic science in the 19th century.

The Grammar of Pāṇini.—Linguistic science in India practically begins and culminates in one great work: the Sanskrit grammar of Pāṇini (probably not later than 500 B.C.) of Salatura near modern Peshawar, Pakistan. It consists of eight "lessons," containing in all 3,873 rules, of which only about 50, or 1.3 per cent, are demonstrably later additions. With it are a list of roots and a table of sounds. The rules are actually definitions of technical terms, of principles followed in the formulation, and of grammatical operations. Unaccompanied by authentic explanations and examples, they are striking by their unrivaled terseness, which is achieved through highly ingenious devices.

Like other works of early Sanskrit literature, Pāṇini's grammar was designed to be committed to memory before it was explained. This accounts for the slight regard paid to systematic

arrangement, such as would be necessary in a book meant to be read and used for reference. The oral transmission did, however, keep the original wording in excellent condition; apart from the few additions, the changes it underwent consist in the omission of certain features of pronunciation that were neglected when the grammar was finally written down—for example, the old tonal and pitch accents, which had become obsolete in later Sanskrit.

Pāṇini's work is neither a school grammar, meant for teaching a language to beginners, nor an academy grammar, meant for establishing a standard of speech usage, but a theoretical explanation of the word formation of the sacred Sanskrit language. It furnishes the proof that Sanskrit bears its name, *sam-skṛta-*, used in the sense of "ritually pure," in the etymological (true) sense of the word: "put (-*skṛta-*) together (*sam-*)." The chief discovery and fundamental doctrine of Pāṇini, as it can be abstracted from his procedure, is as follows:

(1) Each complete nominal and verbal form of Sanskrit consists in principle of three elements, root, suffix, and ending, each of which fulfills certain definite functions. Root and suffix together form a nominal or verbal stem, from which another stem may be derived by a further suffix, before the ending is added. Stated in a formula:

$$\left. \begin{array}{l} \text{Root} + \text{suffix} = \text{primary stem} \\ \text{Primary stem} + \text{suffix} = \text{sec-} \\ \text{ondary stem} \\ \text{Secondary stem} + \text{suffix} = \\ \text{tertiary stem} \end{array} \right\} + \text{ending} = \text{word form.}$$

(And so on)

(2) The elements can rarely be separated by a clean cut. The suffixes, especially, reach into the preceding element by demanding, for example, a special degree of the root vowel (normal, strengthened, doubly strengthened, as in *i : e : ai*; *u : o : au*), a phenomenon now called apophony or ablaut.

(3) In certain cases the ending seems to be added to the root without a suffix, or a secondary stem to be derived from another one without a (secondary) suffix. Pāṇini posits here invisible suffixes, that is, inferrible suffix functions unaccompanied by a perceptible phoneme. The term in modern linguistics is "zero suffix."

(4) The final sound or sounds of a preceding element and the initial sound or sounds of a following element may undergo certain combinations that make the abstract forms of the elements unrecognizable. The conditions for these combinations can be stated in strict rules.

It is Pāṇini's greatest achievement that he applied his principles consistently to almost all instances where they could be applied. His work is the first example in scientific world literature of a theory's being tested empirically by an exhaustive marshaling of the facts. The accuracy and ingenuity with which he executed his functional analysis as well as the soberness of his judgment, which refrains from all forced explanations of resisting material, have created a descriptive presentation of Sanskrit word formation which is still valid in all essential points.

Influence of Pāṇini on the Development of Western Linguistics.—Until the beginning of the 19th century the model for all grammatical descriptions of Indo-European languages (which practically amounts to grammars of Latin and Greek) was the *Tekhnē grammatikē* (*Ars gram-*

matica or *Grammatical Art*) of Dionysius Thrax (fl. 2d century B.C.). Dionysius' description of Greek presupposes an analysis of the flow of speech into sentences, of sentences into words, and of words into their phonetic-acoustic units, the sounds (which were not clearly distinguished from their symbols in writing, the letters). The words were not analyzed into further functional elements. There was no explanation of word formation; the different case forms of a noun were looked upon as alterations of, or deflections or inflections from, an allegedly normal form, the nominative; all finite verb forms, as similar deflections from the first person singular. For Pāṇini, on the other hand, word formation is the central, intrinsic subject of linguistic description; all case forms (including of course the nominative) and all finite verb forms (including the first person singular) are formed from the stem by adding an ending.

Pāṇini's functional analysis of word forms became known in Europe through the first Western Sanskrit grammar (1808), by Sir Charles Wilkins. Following Pāṇini's principles, Wilkins remodeled his enigmatic expressions and his arrangement for the benefit of European scholars and gained, indeed, significant influence, chiefly through the works of Franz Bopp, who in 1816 created a scientific sensation by a monograph on the conjugational system of Sanskrit as compared with that of the Greek, Latin, Persian, and Teutonic languages. By applying Pāṇini's "*Zergliederungskunst*" (analytic art), known to him through Wilkins, to the verb forms of some of the related languages (postulated as such by Sir William Jones in 1786), Bopp was able to show that it works with them, too, and that the elements and the methods of word formation that can be obtained by abstractional observation correspond in the languages he scrutinized in a way that excludes an explanation by similarity due to chance. Besides the method of comparison, Bopp added the idea of historical development, completely foreign to Pāṇini and Indian linguistics in general, and thus became the founder of historically oriented comparative grammar.

Indian Phonetics.—Pāṇini's grammatical description is based not on the linguistic usage of written texts, but on the observed facts of a spoken language. Even before Pāṇini the texts of the older sacred literature (the Vedas) had received scholarly attention. Yet these texts, too, were studied as orally recited. Consequently, there never was in India any confusion between sounds and letters, which was current in Europe and of which the very word *grammar* (derived from Greek *gramma*, letter) is a clear symptom. Concentration on sounds as products of articulating movements led to an empirically founded classification of the sounds already known to, and presupposed by, Pāṇini.

New to Western grammarians was the seemingly simple discovery that different sounds are produced (1) at different "places of the mouth" and hence can be classified as gutturals, palatals, dentals, labials, and the like; (2) with different kinds of articulative "efforts"—occlusion, half occlusion, opening, and so on; and (3) with different "accompanying productions"—aspiration (for example, *kh* against *k*), voice (*k* against *g*), and nasalization (*ṅ* against *g*, *n* against *d*). Dionysius and his followers had nothing to say about the difference between, for example, *k* and *p*. They were satisfied with distinctions like *k*, *p*, *t*

as "smooth," and *kh, ph, th* as "rough," and with designations like that of the occlusives (stops) as mutes. The acquaintance with the empirical analysis of the production of speech sounds as practiced by the old Indian phoneticians furnished the starting point and foundation for modern phonetics, which had to add only refinements of their basic discoveries, won by still more accurate observation and a wider experience in different speech forms.

Later Developments of Linguistics in India.—Of the huge literature in Sanskrit complementary to Pāṇini's grammar, the two earliest preserved works are also the most significant. Kātyāyana's *Vārttika* ([Investigation] Pertaining to the Procedure [of Pāṇini], 3d century B.C.) and Patanjali's three-volume *Mahābhāṣya* (*Great Prose Work*, 2d century B.C.). They are devoted to the task of discussing the logical and factual correctness of Pāṇini's definitions. It is only later that actual commentaries, designed to explain Pāṇini's grammar and with the help of this explanation to settle which forms can and must be considered correct, come into existence. The oldest of these is the *Kāśikā* ([Commentary] from Varanasi [*Kāśī*], 6th century A.D.).

Of general interest for the history of linguistics are certain discussions of theoretical problems in Patanjali. Among these are the relation of speech sound and meaning (discussed also by Plato), the meaning of grammatical gender, and the difference between abstract concept and the concrete representative of a concept as named by a linguistic sign. Though full of sagacious observations and remarkable for their empirical method, these discussions had no influence on the development of modern linguistic science, partly because they remained unknown except to a very few specialists and partly because they are not free of the influence of certain dogmatic views held with respect to the nature of Sanskrit as a sacred language. The same holds good with respect to etymological procedures as developed by Yaska (later than Pāṇini, but earlier than Patanjali) or Indian lexicography (collections of homonymous and synonymous words), which often contain useful factual information, but reveal no outstanding skill in exegetic methods, nor any adequate insight into the problematics of semantics.

An attempt at comparative grammar was made in certain works on vernacular languages (Prakrit), related to Sanskrit, that study (among other subjects) the sound correspondences between Sanskrit and these vernaculars by establishing strict and comprehensive rules. (The oldest of these works is the Prakrit grammar of Vararuci, which cannot be dated accurately, but most probably is not earlier than some centuries after Christ.) The sound correspondences are taken as seriously as in modern comparative grammar, although there is no historical perspective as adopted and developed by Western scholars since the mid-19th century.

See also 11. *Literature—Classical Literature*; and separate articles on LANGUAGE, SCIENCE OF—*History of Linguistics*; PRAKRIT LANGUAGES AND LITERATURE; SANSKRIT LANGUAGE.

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11. LITERATURE

CLASSICAL LITERATURE

Classical literature in India must be understood not as a literature of a particular period

or a particular kind, but as the literature composed in Sanskrit, the sacred language of the Brahman religion, in its different stages. By descent, Sanskrit is one of the Indo-European languages; it was imported into India in the 2d millennium B.C. by immigrants from the West who called themselves Aryans (Sanskrit *Ārya*). Its nearest relative is Old Iranian, as attested in the Avesta (the sacred texts of the Zoroastrians) and in the Old Persian cuneiform inscriptions of Darius I (r. 522–486 B.C.). Geographically, Sanskrit is a northwestern dialect, which through the medium of ritual usage and learned education spread, in the course of the 1st millennium B.C., as a kind of lingua franca throughout the Indian peninsula. Sociologically, it represents the standard of educated speech set by the priestly caste, the Brahmins. It is used for literary purposes first in priestly poetry, then in all kinds of other compositions of a ritual, scientific, and, ultimately, of an entertaining character. Chronologically, it may be divided into Vedic, the language of the earliest literary monuments; early classical, the language of early scientific prose; and late classical and postclassical, the language used in varying grades of purity in the epics and the later, highly stylized poetry and prose (as such, it has continued to exist, in an ever-decreasing degree of importance, into the 20th century).

Sanskrit literature is classic in the sense that it actually played the role of a model for other old Indian literatures as they developed in dialects related to Sanskrit and in such unrelated languages as Tamil. It is classic also in the sense that it has a claim to be ranked among the great world literatures with regard to scope and variety of the subject matter, accuracy and depth of thought, formal strictness, and polish of expression. As such, it is of intrinsic interest as one of the values of man's heritage, embodied in ideas and forms created and preserved by literary art. Like all human values, this value is relative, and an attempt to appreciate it involves giving up the notion that Western standards of esthetic measurement are absolute and strictly objective. The chief interest of Sanskrit literature for Western man certainly lies in its being a rich source for the history of religion, philosophy, and scientific thinking.

For practical purposes we include in this survey two branches of old Indian literature not in Sanskrit, but in related vernacular speech forms. Prakrit literature is in part directly connected with Sanskrit, and in part constitutes the sacred and scholastic literature of the Jains. Pali literature is exclusively Buddhist.

Vedas.—*Rig Veda.*—*Origin and Tradition:* The oldest document of Sanskrit literature is a collection (*samhitā*; Sanskrit *saṃhitā*) of 1,028 hymns called the Rig Veda (*R̥gveda*; Knowledge of Verses), the work of various poets of the 2d millennium B.C. There is no doubt that these hymns were composed without the help of the script and were for many centuries handed down exclusively by word of mouth. This oral tradition left the text free of any significant corruptions, as can be demonstrated by linguistic, exegetic, and metrical investigations, which vindicate the correctness of the traditional text (except for certain accurately definable modernizations concerning pronunciation and enunciation).

Contents: The hymns of the Rig Veda are celebrations of various gods, meant in the main for recitation at the solemn fire ritual. The nature

of this poetry can be understood only when it is related to the nature of the gods it praises and to its prehistoric origins. Some chief figures among these gods are Agni, Soma, Indra, and the Adityas.

Agni is the personification of fire (*agni*, related etymologically to the Latin *ignis*, fire) regarded in its different aspects—for example, as devastating forest fire; more often, as the household fire that presides over and protects the family; as the fire used in the cremation of the dead; and chiefly, as the ritual fire on the sacrificial ground that brings the sacrificial gifts to the gods, or around which the gods are supposed to gather as the guests of man, who offers them food and drink and honors and entertains them by the recitation of poetry. Agni himself is often described as the divine poet and priest, whose poetry is in the crackling of his flames.

Soma (Avestic Haoma) is the personification of an exhilarating drink (soma; literally, pressing) won from the stalks of a particular plant. He helps the poet in his ecstatic concentration and supports other gods in their heroic feats. His descent from heaven and his return to it after he has been ritually purified are the subject of a difficult mysticism, a complicated ritual, and some colorful legends.

Indra (in the Avesta the name of a demon) is the god of victory. His originally rather abstract figure is embellished by lending it the features of a dragon-killing hero and ascribing to it the primordial feats of setting free the water, the light, and the milk-giving cattle through an initial victory that creates the conditions for life.

The Adityas are a group of gods who personify ethical concepts: Varuna (True Speech), Mitra (Contract, Treaty), Aryaman (Hospitality), Bhaga ([Fair] Share), and so on. Like Soma and Indra, they have some exact correspondences in the Avesta, where we find the gods Mithra, Airyaman, and Baga. Consequently they must be explained as inheritances from the time when the Aryans (the Indo-European-speaking Indians and Iranians) still used a common speech form and constituted a common national community of some kind. Varuna, Mitra, and Aryaman center around the (neutral) concept *rita* (*ṛta*, truth), conceived as immanent in all ethical behavior and also as a miraculous creative power through which the universe was established as a system of interrelated entities and dependable happenings (sunrise, rain, alternation of day and night), guaranteed by divine vows (*vrata*), to which corresponds man's vow to abide by truth and to offer sacrifices. The sacrifice is a re-enactment of this primordial covenant between man and gods.

The hymns themselves are conceived as formulations (brahman) of esoteric revealed truths concerning the divine powers and their characters and achievements. As formulations of esoteric truth, they are loaded with its miraculous power. The Rig Vedic poetry is, then, quite a unique kind of literature, based on a combination of an imaginative polytheism, an ethical interpretation of life, and the conviction of the spell-like working of truth formulated in speech.

Form: In contradistinction to the *Homeric Hymns*, which are epic in character, the hymns of the Rig Veda are lyric and dithyrambic. A god's feat is not recounted but is celebrated in a gorgeous, but often sketchy, even abrupt style. The poets are fond of hidden implications, sudden

interruptions, and striking images, sometimes striving after artificial ambiguity and mystic obscurity. Only occasionally is a legend treated in a more coherent manner, but even then the style is balladic rather than epic, the theme being developed in a dramatic dialogue full of allusive references from which the frame of the story must be reconstructed.

It is obvious that this characteristic, highly developed style must be the result of a long poetic practice that reaches back far into prehistoric times. The nearest ancestor of Rig Vedic poetry, a proto-Indo-Iranian poetry, can be reconstructed in abstract outline by a comparison of the oldest Iranian sacred poetry, which shows a great number of close correspondences in subject matter, in diction, and in metrical patterns. Its further removed ancestor, a proto-Indo-European poetry, can be dimly recognized by a comparison of old Greek lyric and epic poetry, which also shows certain definite correspondences in diction and metrics. The most important figures of Vedic and Iranian religion, however, cannot be traced back to proto-Indo-European times.

Later Vedic Literature.—The *Other Collections*: The hymns of the Rig Veda were recited at the fire sacrifice by a particular priest, the *hotṛ*- (Old Iranian *zotar*, reciter). At certain occasions of this sacrifice hymns were sung on a melody by the *udgātṛ*- (singer), for whose study all the Rig Vedic hymns used in this way were collected in the *Sāma Veda* (Knowledge of Melodies). On other occasions a third priest, the *adhvaryu*-, whose chief function was the execution of the ritual acts themselves, had either to recite single verses or to mutter prose formulas. This material is collected in the *Yajur Veda* (Knowledge of the Sacrificial Prayers), preserved in different school texts (the main divisions are the Black and the White *Yajur Veda*). In part it repeats verses from the Rig Veda, and in part it adds verses of its own that are closely patterned on Rig Vedic models. There are also a number of prose formulas that have some close correspondences in the Avesta, which proves the prehistoric age of this genre of composition.

The latest of these *samhitā*, the *Atharva Veda*, is the only one that has no specific relation to the fire sacrifice. In contrast to the *Yajur Veda*, it contains chiefly hymns, and these are in style and diction obviously imitative of the elaborate poetic art displayed in the Rig Veda. They are meant to accompany magic practices as used outside of solemn rites: Actually they are charms for giving effectiveness to healing plants, relieving the pains of labor, endowing an amulet with power, and so on. As to content, they have to be ranked with spells as we know them from all over the world; as to form, they are solemn poetry. This peculiar combination lends the *Atharva Veda* its particular interest for the study of magic religion and for that of literary forms.

Brāhmanas and Upanishads: The oldest example of prose composition (prose sentences built into a unified artistic whole) is furnished by the texts called *Brāhmanas* (works containing formulations, brahman, of the truth). These texts, the oldest of which form part of the Black *Yajur Veda* collections, are concerned with stating and explaining the esoteric, mystic significance of single ritual acts. Partly narrative and partly argumentative, they are couched in a strict and terse language, which is of an impressive directness, accuracy, and stylistic consistency—the

forerunner of later scientific prose.

Considerably later than the Rig Veda, the Brāhmaṇas are earlier than the earliest (prose) Upanishads (*Upaniṣad*; literally, Worshipful Approaches) that speculate and argue in a manner similar to that of the Brāhmaṇas (not, however, on ritual acts, but on the essence of nature and the universe). They have charmed Western philosophers by their monistic attitude, which is essentially atheistic and materialistic. It is more akin to Greek pre-Socratic philosophy than to Plato's idealistic and moralistic interpretation of the world. If it is Plato's aim to improve man by making him wiser, the purpose of the Upanishads is to offer truth as a magic weapon to obtain practical ends, the highest of these being salvation. Their basic outlook is best characterized as magic philosophy or philosophical magic. The argumentation of the Upanishads is more assertive than persuasive. It is ruthless in demolishing confidence in appearances and reducing them to their essential "beingness." Besides much deductive speculation, it offers remarkable instances of reasoning by induction and experimentation.

The oldest Upanishads may be said to contain in germ most of the basic issues of later Indian philosophy, including the dogma of transmigration (foreign to the older Vedic tradition); the doctrine of the partition of matter into fire, water, and earth, which by combining in different ways constitute all that can be perceived by the senses; and the postulate of the self (atman; Sanskrit *ātman*) as the unqualifiable, imperishable "reality's reality," which is only temporarily imprisoned in finite bodies. Later these ideas are partly developed and amalgamated with theistic beliefs, as in the *Bhagavad Gītā*; partly attacked and refuted, as in Buddhist philosophy; and partly reinterpreted and fitted into new systems, as in the philosophy of Vedānta, represented in its two classic branches by Śaṅkara (Śaṅkara, fl. about 800 A.D.) and Rāmānuja (fl. probably 12th century).

Scientific Literature.—Scientific literature in the proper sense begins with the old Sūtras, which describe the complicated rites of the Vedic fire sacrifice. The name Sūtra (literally, means of sewing, thread) derives most probably from these descriptions aiming at "sewing together"—that is, arranging according to their sequence and coordinating—the single sacrificial acts and verses into a unified body. Characteristic of all the Sūtras is their relentless striving after brevity of expression and their purely factual point of view, which leaves no room for any attempt at explanation.

Factual description as a means of making clear and proving a theory is found first in the grammar of Pāṇini (fl. probably not later than 500 B.C.), which describes the processes of the word formation of Sanskrit in the light of the assumption that words consist of smaller functional elements (root, suffix, ending) and that they are put together (*sam-skṛta*) according to strictly definable methods.

Descriptions of a less rigorous character, partly in verse, are other works dedicated to the simpler customs of the home ritual and private life (*Gṛhyasūtra*) and of traditional customs sanctioned by the Brahmins in a wider sense (*Dharmasūtra*). Occasionally they approach the character of versified law codes, of which the most famous is the *Manu Smṛti* (*Tradition of Manu*).

In later times, from about the 3d century B.C.,

scientific works are preferably composed as discussions of and commentaries to older authoritative texts. The classic model for this type of scholastic investigation is Patanjali's *Mahābhāshya* (*Great Prose Work*, 2d century B.C.) on Pāṇini's grammar. It shows distinctly how this kind of composition came into existence: it is a literary stylization of conversations between scholars examining exegetic, logical, and material difficulties found in earlier works by raising points of objection and seeking answers that would remove them. As Patanjali himself tells us, Sanskrit was then still a spoken language in part of northern India. This is borne out by the freshness of his style, which successfully imitates the manner of spoken speech by its short, often elliptical sentences and idiomatic phrases. Later, when Sanskrit had become a pure school language, the style of the commentaries is increasingly abstract and abstruse.

A similar line was followed by the development of philosophical literature, which was earlier composed in Sūtra style and later in commentary style. It is by nature logical, epistemological, and metaphysical, its epistemological and logical aspects coming more and more to the fore, and in the end absorbing almost completely all other interest. Important for the comparative study of philosophy are the Indian system of topics (*padārtha*), corresponding to a certain degree to Aristotle's categories; the Indian atomistics; and the Indian investigation of knowledge by inference (*anumāna*), corresponding to the syllogism of Western formal logic.

The recognized triad of ways of life—according to dharma (pious custom), artha (practical purpose), and kama (Sanskrit *kāma*; sensual desire)—led to the complementation of the existing dharma literature by works teaching the artha (the outstanding example is the *Kauṭīliya Arthaśāstra*, the core of which is of the late 4th century B.C.) and the kama (the outstanding example is Vātsyāyana's *Kāmasūtra*, ill reputed but of high ethnological and folkloristic interest).

Entertaining Literature.—Epic Poetry.—Storytelling reaches the level of literature when it becomes an art which follows certain patterns of form and style. In India as elsewhere, one of the basic kinds of narrative literature is the epic poem, whose most general characteristics are its metrical form and its leisurely style, which unfolds the story with constant attention to detail and frequent digressions. The oldest and most important Indian epic poems are the *Mahābhārata* (*Great Tale of the Descendants of Bharata*) and the *Rāmāyana* (*Life of Rāma*). Both are composed in a Sanskrit that here shows some popular influence, particularly in the *Mahābhārata*; both are composed in meters that can be derived from Rig Vedic ones; and both are full of religious themes and are regarded, with increasing veneration, as sacred works. The *Mahābhārata* purports to be a story told by a sage of old at a sacrifice. The link to Vedic tradition is thus apparent. Obviously it is just these Brahmanical features (language, meter, ritual background) that have raised old folk tales and legends to the rank of literature thought worthy to be handed down in this particular form to posterity.

The *Mahābhārata*, though younger than Vedic literature, is not later in origin than the second half of the 1st millennium B.C., though it may contain some more recent additions. It is a gigantic work, comprising in its present form about

100,000 verses. Its main theme is the great war between two sets of hostile cousins, the Kurus or Kauravas and the Pāṇḍus or Pāṇḍavas, which culminates in a huge battle in the plains north of Delhi. The course of events is frequently interrupted by inserted tales, often of considerable length, related by figures playing a role in another story (the technique of stories within a story). These episodes are of a remarkable variety and furnish much of the basic material of later narrative literature. The best known is the conversation of the Pāṇḍu hero Arjuna with his charioteer Krishna (*Kṛṣṇa*) on the duties of a warrior king, held at the beginning of the battle. It is not only full of ethical reflections, but contains the chief tenets of Hindu faith as connected with the worship of Vishnu: Krishna reveals himself as one of the incarnations of the god, assumed by him to help mankind in time of distress. This is the *Bhagavad Gītā* (*Secret Wisdom Sung by the Lord* [Krishna]), one of the main sources of edification and inspiration for modern Hindus (it was Mohandas K. Gandhi's favorite work).

The *Rāmāyana*, which is shorter and more polished, and which keeps more consistently to its main subject, relates the heroic adventures of the prince and later king, Rāma, victor over the demon king Rāvaṇa, who had abducted his wife, Sītā. In his conquest of Rāvaṇa's island capital, Lanka (later identified with Ceylon), Rāma was helped by an army of monkeys, whose leader, Hanumān, became a popular figure of the Hindu pantheon. Like Krishna in the *Mahābhārata*, Rāma is considered to be an incarnation of the god Vishnu, while Sītā is venerated as the prototype of noble Indian womanhood.

Later epics in Sanskrit, the Purāṇas (Old Stories), take up and develop certain themes of the older epics, especially the Krishna legend; they have become the chief source of modern Hindu legend and mythology. The *Rāmāyana* was revived and given its finally valid form by the poet Tulsī Dās (1532-1623) in his *Rām-carit-mānas* (*Wonderful Lake of the Life of Rāma*), composed in Hindi.

Learned Poetry (Kāvya) and Prose.—The narrative poetry of the *Rāmāyana* is, in style and manner, the model of later artistic poetry, which tries to emulate it and certainly surpasses it in formal polish. In general, it can be maintained that the later a poem is, the less original are its contents, the more elaborate and accomplished its external qualities. The learned character of this poetry, which is sociologically a court poetry, would be evident even if we did not have certain works that, in the Sūtra style, lay down rigorous rules for poetic composition.

The oldest well-known poets of this kind are Aśvaghosha (fl. about 100 A.D.), a Buddhist who in his epic poem *Buddhacarita* (*Life of the Buddha*) endeavored to give the Buddhists a Sanskrit epic that could replace for them the *Rāmāyana*; and Kālidāsa (fl. about 5th century A.D.), the universally recognized classic of this style. Kālidāsa's epics are elaborate versions of tales taken from the old epics and the Purāṇas: *Raghuvamśa* (*Lineage of Raghu*) tells the legendary history of the ancestors and descendants of Rāma and the Rāma story itself; *Kumārāsambhava* (*Origin of the God Kumāra*) relates the happenings that led to the wedding of the god Shiva (*Śiva*) and Pārvatī, the daughter of the Himalaya. The lyric elements in these poems are so strong as almost to cover the epic fundament. Kālidāsa's

imaginative description of nature, which appears in a pure form in his most famous work, *Meghadūta* (*The Cloud Messenger*), is unparalleled in classic Hellenistic and preromantic European poetry. Actual observation and a genuine pleasure in nature's beauty find here a romantic, sentimental, and idealizing expression that enchanted European poets like Johann Wolfgang von Goethe.

An equally great impression was made by Kālidāsa's play *Sakuntalā*, the first work of Sanskrit literature to be translated into a European language (by Sir William Jones, in 1789). Even here the treatment is prevalently lyrical. The theme is again taken from the epics (*Mahābhārata*), as is that of many other Sanskrit plays. Other types of plays deal with courtly love stories. Only one play, *Mṛcchakatika* (*The Little Clay Cart*), which in its original form is older than Kālidāsa, has a realistic contemporaneous background and presents an interesting picture of life in a medieval Indian city.

From a still later time we have some prose novels, similarly composed in a highly artificial style meant to appeal to learned palates. The most original is Daṇḍin's *Daśakumāracarita* (*Adventures of the Ten Princes*, 6th or 7th century A.D.), which can be compared to *The Little Clay Cart* in its vivid description of contemporary life. Notwithstanding its sophisticated and difficult language, it can be enjoyed as a picaresque novel.

Sanskrit sententious poetry is perhaps more to Western esthetic taste; this consists of short verses in a comparatively easy style, dealing with themes of ethical and worldly wisdom, and also with the joys and griefs of love. The chief representative is Bhartṛhari (Bhartṛhari, fl. probably 7th century A.D.).

The writing of history as a sober and serious attempt at relating past or contemporaneous happenings is unknown in India. The few lyric-epic poems or prose compositions that deal with royal history are more often than not on the other side of the border line that separates fact from fiction. Worth mentioning in this connection are some panegyric inscriptions (*prāśasti*) like that on a stone pillar in Allahabad (345 A.D.) celebrating in *kāvya* style the war feats and the learned accomplishments of King Samudragupta (r. about 330-375/380 A.D.). Kalhana's *Rājataranginī* (*River of Kings*, 12th century A.D.), a poetic chronicle of Kashmir, is comparatively sober and helpful for historians.

The great mass of Sanskrit fable literature is of a pseudolearned character. Its sources are obviously simple popular tales, whose heroes are chiefly humanized animals. The language of the Sanskrit fables is strongly influenced by popular speech, though it tries to imitate *kāvya* style. Ostensibly the fables are told and arranged to teach worldly wisdom, especially of a political nature, and are considered a kind of *Arthaśāstra*. They have found their way into many countries outside India. The chief representative of the genre is the *Panchatantra* (Sanskrit *Pañcatantra*).

Vernacular Literature.—Prakrit Literature.—Prakrit language as a vehicle of literary expression is found in Sanskrit literature proper in the plays. Here different persons speak in different dialects, the geographical distinctions of the dialects being treated (in a manner not quite true to life) as distinctions of social level. This rather strange practice seems to point to the origin of Sanskrit drama as a shadow play, such as is still found in parts of southern India and

flourishes in Java. In a shadow play it was of course necessary to find a means of distinguishing clearly between the speeches of the different actors, which were actually spoken by one person, the *sūtradhāra* (holder of threads), as the "theater director" is still called in Sanskrit.

Learned lyric-epic poems in Prakrit imitate exactly Sanskrit prototypes, as does Prakrit sententious and lyric poetry. More independent of Sanskrit models is the literature of the Jain religion, composed in two different old vernaculars, corresponding to its two sects, and later in Apabhramsa, a more modern form of Prakrit that forms an intermediate stage to the modern dialects. The Jain literature is especially remarkable as a treasure house of tales. *The Arabian Nights* contains quite a few motifs that may be of Indian (Jain) origin and shows a striking similarity in its elaborate use of the technique of stories within a story, as perfected in Jain narrative literature.

Buddhist Literature.—The canonical records of southern (Hīnayāna) Buddhism, the Pali Tipiṭaka (Three Baskets), consisting of the Vinaya Piṭaka (Basket of Religious Training), Sutta Piṭaka (Basket of Teachings), and Abhidhamma Piṭaka (Basket of Things Relating to the Doctrine), are composed in a stylized vernacular. Actually a mixture of several vernaculars, and possibly a lingua franca for north Indian trade, this is basically a northeastern dialect (Ardhamagadhi) of a much more archaic form than the literary Prakrits. The Tipiṭaka, which is the most important text of Buddhist literature, contains the life story of the Buddha and a number of his sayings, more or less faithfully handed down by oral tradition. It is a collection of chronologically different layers; the oldest consists of verses in a particularly archaic language, connected by prose narrative and commented upon at a later time. Aside from its interest for the history of Indian philosophy and religion, the oldest Buddhist literature is interesting for its store of legends and tales, partly original and partly corresponding to the Sanskrit epic tradition, with which it may have culled from the same popular sources, and to Sanskrit sententious poetry. The *Jātakas*, stories dealing with former births of the Buddha that form part of the Sutta Piṭaka, offer the earliest instances of Indian fable literature.

Since the time of Aśvaghosha there have been numerous attempts at providing Buddhism with a literature in Sanskrit. These are characteristic of the northern (Mahāyāna) school, which was exported to Tibet and China. Here there exist numerous translations from Buddhist Sanskrit that complement our knowledge of texts preserved in Sanskrit. The Sanskrit of the northern Buddhists (with the exception of Aśvaghosha) is heavily mixed with elements from Pali and other vernaculars, and the question has been raised of whether it was originally meant to be Sanskrit at all or whether it is in fact rather a particular, superficially Sanskritized vernacular. The texts in this Buddhist hybrid Sanskrit are of great value for the study of the history of northern Buddhism as it was developed by its monks. There is a growing tendency to adorn the originally simple and touching story of the Buddha by the introduction of miracles and to replace the older plain narrative prose by a style strongly redolent of Sanskrit court poetry and prose.

See also 8. *Dance, Music, and Drama*; 10. *Linguistic Science*; 12. *Science—Ancient and Medi-*

eval Period; 13. *Religion and Philosophy—Religion and Philosophy of Indian Origin*; 14. *Law*; and separate articles on BHAGAVAD GITA; BRAHMANAS; DRAMA—*Indian Drama*; MAHABHARATA; ORIENTAL THEATER—*India*; PRAKRIT LANGUAGES AND LITERATURE; RAMAYANA; SANSKRIT LITERATURE; UPANISHADS; VEDIC LITERATURE.

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MODERN INDO-ARYAN LITERATURE

The modern literatures of India serve to record the interacting social, political, historical, economic, and intellectual forces which gave impetus and direction to the development of the country. Their evolution demonstrates the striking changes brought about by contact with the West. (For the earlier literature in these languages, see separate articles on them.)

Introduction of Western Influences.—Several events stimulated the dormant Indo-Aryan literatures in the early 19th century. Among them were the establishment in 1800 of the College of Fort William in Calcutta; the introduction of printing, accompanied by the standardization of orthography and fonts, and the more extensive use of punctuation; and the decision of the government of Bengal in 1835 to make English the medium of instruction in the schools for lower-echelon government officials.

The College of Fort William was established to train British civil servants in the languages, history, law, and customs of the country. Since their administrative duties required them to be conversant with the colloquial dialects, a portion of the college's curriculum was devoted to this study. This official recognition eventually influenced the progressive element among educated Indian groups, which was curious to explore the avenues opened by the new Western ideas, to cultivate the colloquial languages for literary purposes. Added impetus was given by the printing press, which made possible the development of a large reading public, in sharp contrast to the limited audiences that had hitherto been reached by literary works transmitted either through manuscripts or through readings by authors or by *kathaks* (professional reciters).

Although some Indians were acquainted with French at the beginning of the 19th century, it was the introduction of English education which made European knowledge available to India and revealed new literary forms—the novel, the novellette, the short story, the essay, the newspaper article, biography, literary criticism, and, in dramaturgy, the tragedy and the one-act play—to whose exploration the young writer eagerly applied himself. Even after the achievement of independence in 1947, English continued to play an important role in Indian life.

Development of New Themes.—Prior to the 19th century renaissance verse composition was the principal literary activity in India. The countless treatises prescribing methods of versification and the selection and treatment of the preponderantly religious or philosophical themes underscored the severe restrictions placed upon the author. Innovation was further discouraged by the conventions set by the classical literatures—Sanskrit for the Hindus and Persian and Arabic for the Muslims. The literary languages which evolved, with their vocabulary and syntactic constructions borrowed directly from the classical literatures, were actually special di-

alects, distinct from those employed in everyday communication. An example of this is the contrast between the *sādhū bhāṣā* (literary language) and the *cholī bhāṣā* (colloquial language) in Bengal.

The new movements broke away from tradition. Poets turned to an alien literature, English, for their models and inspiration, and they experimented with new meters and attempted to revive older indigenous verse forms. Among the imports from the West were blank verse and the sonnet. The epic was refashioned, with emphasis on the narrative aspect instead of the traditional religious aspect, and the lyric, which hitherto had existed only as part of a larger composition, was cultivated as a separate entity. A striking feature of the new age was the emergence of prose, which previously had been confined mainly to philosophical treatises or to such narrative expositions as the fable or fairy tale and the romance. While poetry was not entirely free of the hobbles of tradition, prose lent itself readily to new influences, cultivating the colloquial rather than the literary languages.

The new themes dramatized the changes in attitudes induced by Western influences. Secular and popular subjects replaced the religious and esoteric. The writer's attention was focused on man and his earth-bound trials and tribulations instead of the overworked exploits of gods and mythic heroes with their stereotyped treatment, as prescribed by the antique standards. The novelist, with European works as models, constructed his plots around the realities of daily life and the problems which perplex the individual in a society in transition. A favorite topic was the need for social reform, specific attention being given to the lot of men caught in the toils of the caste system and to the disabilities suffered by women—illiteracy, early marriage, and enforced widowhood. In time the historical novel and the mystery novel each found a loyal public. Caught up in the nascent nationalist movement, writers turned to India's past for inspiration, fashioning the glorious exploits of former times into an expression of the awakened aspirations for nationhood.

Modern Literary Forms.—By the 1920's the short story had surpassed the novel in popularity in India. This literary form, devised to express a single mood or experience, is distinctly a European import, unrelated to the indigenous folk tale. It has been handled in various ways. Some writers have concentrated on the description of events. Others, like Prem Chand (1880–1936), have turned to characterization. Prem Chand was the first to choose for his dramatic personae representatives of social classes other than the elite. His pages bewail the plight of the hapless peasant and the frustration of the woman powerless to cope with adversity. Still others, experimenting with socialist theories, have directed their words to the very persons on whom their characters are modeled in order to guide and instruct them in the improvement of their condition. Meanwhile, criticism continues to be leveled at writers who employ themes considered foreign to Indian social patterns, such as the love marriage and psychological problems created by a preoccupation with sex.

Several reasons have been suggested to explain the popularity of the short story over the novel. One is the far longer time required for the production of the novel. In India, where

the writer can rarely depend on his pen alone for his livelihood, this is a significant factor. Moreover, publishers willing to take the risk of printing novels are few as compared with the magazines devoted solely to the short story.

Mention must also be made of the work of journalists and editors, especially the latter, around several of whom important schools of writers developed. In literary criticism, Indians adopted English standards to the point of quoting Western critical works for authority and of resorting to European writing for examples of the literary craft.

Modern tragedy, though lacking the popular appeal of comedy, made its way upon the Indian stage in the 20th century. Indian dramaturgy had had no counterpart to the tragedy of the West, in which the development of the plot is attendant upon the free acts of the protagonists. In the traditional Indian drama the hero and heroine, after overcoming innumerable obstacles, are joyously reunited. The wicked man is foredoomed, for, according to Hindu theory, a man's acts and present existence are strictly determined by karma, the consequences of acts performed by him in an interminable series of previous births.

Until the attainment of independence in 1947 the struggle for freedom monopolized the Indian writer's attention and was his chief source of inspiration. The new nation was slow to find literary expression, however, for with the end of foreign rule as a focus of attention the writer was caught up in the pull of diverse forces, significant among them the subnationalist tendencies reflected in the demand for linguistic states. Acutely aware of the need for communication among writers, one Indian critic suggested that arrangements be made available for the translation of works in the various languages. Hindi, the national language, was proposed for this function, but did not receive wholehearted acceptance.

Bengali Literature.—It is generally acknowledged that Bengal sparked the Indian literary movements of the 19th century. Rām Mohun Rai (Rām Mohan Roy, 1772/1774–1833), the great reformer, pioneered in literary prose. *Digdarshan*, the first vernacular journal, appeared in 1818, and it was followed in 1831 by *Sambad Prabhākara*, a literary review founded by Ishwarchandra Gupta (1806–1858), the father of Bengali journalism. Many writers of the period began their careers on Gupta's newspapers.

Blank verse, a significant import from the West, was introduced in the epic *Tilottama*, by Michael Madhu Sudan Dutt (1824–1873), who also experimented with the sonnet form and wrote the first comedy and the first tragedy in Bengali. Bankim Chandra Chatterji (1838–1894), who with his social and historical novels inaugurated modern Indian fiction, holds uncontested claim to the title of Bengal's greatest novelist.

In 1913, Bengali literature received international recognition by the award of the Nobel Prize for literature to Rabindranath Tagore (1861–1941), India's greatest man of letters. Poetry, drama, fiction, essays, criticism—there was no form of literature that his genius had not mastered.

The first financially successful writer was Sarat Chandra Chatterjee (1876–1938), whose loyal readers made it possible for him to depend on his pen alone for his livelihood. Among later writers are Buddhadeva Bose (1908–), poet,

essayist, short story writer, and critic; and Bibhuti Bhushan Banerjee (1896-1950), novelist and short story writer, whose *Pather Panchai* (*Song of the Road*) won international acclaim when it was translated to the motion picture screen. The novels and short stories of Annada Sankar Ray (1904-) are distinguished by their subtle characterization, while Tarasankar Bandyopadhyay (1900-) owes his great popularity to his studies of regional life.

See also **BENGALI LANGUAGE AND LITERATURE.**

Hindi Literature.—The initial phase of modern Hindi literature was dominated by Bharatendu Harishchandra (1850-1883) and by Mahavirprasad Dwivedi (1868-1938), who fostered many fledgling writers in his journal *Saraswati*. Dwivedi also molded standard literary Hindi into a tool worthy of the genius of Prem Chand, who first attracted recognition by his works in Urdu.

The period between World Wars I and II saw two significant movements in Hindi. The first, known as the *châyāvāda* (romanticism), was characterized by a revolt against formalism and didacticism. It concentrated mostly on poetry, and its leading spokesmen were Nirala (pseudonym of Suryakant Tripathi, 1896-) and Sumitranandan (Sumitranandan) Pant (1900-). The second was *pragativāda* (progressivism). It developed as a reaction to the romanticism of the *châyāvāda* and, influenced by Marxism, concerned itself with the realities of daily life and the plight of the downtrodden segments of society. It had among its adherents Yashpal (1904-) and Nagarjun (1911-).

To the post-World War II period of the *mayi kavita* (new poetry) belongs Ajñeya (Agyeya, 1911-), who represents the *prayogavāda* (experimentalism). Later fiction writers directed their attention to the life and folkways of their particular regions.

See also **HINDUSTANI LANGUAGE AND LITERATURE.**

Urdu Literature.—The moving force behind the revival of Urdu was Sir Sayyid Ahmad Khān (1817-1898), the founder of the Aligarh movement, which sought to harmonize Islamic culture with Western learning. Asad Allah Khān (called Mirza Ghālīb, 1796-1869), Muhammad Husain Azad (d. 1910), Altāf Husain Hālī (1837-1914), and Muhammad Iqbal (1876-1938) are the brightest luminaries of Urdu poetry, the last outshining all the others. Prem Chand, mentioned above for his work in Hindi, is considered to have given the Urdu short story its form, and his *Maidan-e-Amai* (*The Field of Hope*) inaugurated the modern Urdu novel. Between his death in 1936 and the creation of the two nations of Pakistan and India in 1947 many writers received recognition for their work in the short story and the novel, among them Saadat Hasan Manto and Krishna Chandra. The tragedy of partition was reflected in writing on both sides of the new boundaries.

Gujarati Literature.—The chief figures of the first period of modern Gujarati literature (1850-1885) are Kavi Dalpatram Dahyabhai (1820-1898), who served as a link with the traditional literature; and Narmadshankar (1833-1886), the architect of modern Gujarati. The interest in the new literature was reflected in the number of literary societies that were formed at this time, among them the Gujarat Vernacular Society and the Forbes Gujarati Sabha, both of which were still active in the mid-20th century.

The next period (1885-1914) was distinguished

by the novel *Sarasvatichandra*, the first great classic of Gujarati fiction, by Govardhanram Tripathi (1855-1907), from whose characters Gujarati readers drew inspiration for many years. His contemporaries were Manilal Nabhubhai Dvivedi (1858-1898), essayist and critic; and the poets Narsimhrao Divatia (b. 1839) and Kavi Nanaial Dalpatram (b. 1877). Kaniyalal M. Munshi (1887-), politician, lawyer, and littérateur, who bridges this and the following period, explored the various literary forms from the essay and the social drama to autobiography. He attained the greatest popularity with his historical novels.

The philosophical and political writings of Mohandas K. Gandhi (1869-1948), the simplicity of whose prose style wielded a strong influence on the language, dominated the next phase (1914-1948). Novelists who have made important contributions to the new India are Darshak (pseudonym of Manubhai Pancholi) and Pammalel N. Patel (1912-), the latter esteemed for his rural tableaux. Among later short story writers are Gulabdas H. Broker (1909-), Jayanti G. Dalal (1909-), and Chunilal K. Madia (1922-). Translations from foreign and other Indian authors are numerous.

See also **GUJARATI LANGUAGE AND LITERATURE.**

Marathi Literature.—The year 1885, which saw the publication of the first poem of Keshavsut (pseudonym of Krishnaji Keshav Damle, 1866-1905) and the first novel of Hari Narayan Apté (1864-1919), marks the beginning of modern Marathi. Effective prose styles were developed by Gopal Ganesh Agarkar (1856-1895), on the one hand, and Lokmanya Bal Gangadhar Tilak (1856-1920) and Vishnushastri Chiplunkar (1850-1882), on the other, in the course of their spirited debates over social and political reform, which appeared in the newspapers *Sudharak*, edited by Agarkar, and *Kesari* and *Maratha*, under the direction of the two latter.

The period 1920-1945 was characterized by contrasting schools of poetry—the romantic, led by Bhaskar Ramchandra Tambe (1874-1941), and the realistic of the *ravikiran mandal*. Novelists of this period include Vaman M. Joshi (1882-1943), Shridar Venkatesh Ketkar (1884-1937), Vishnu Sakharām Khandekar (1898-), and Narayan Sitaram Phadke. The short stories of Phadke and Khandekar, who continued their activity in the next period, set a model for the form, in reaction to whose artificiality Y. G. Joshi fashioned his sketches of home life.

After World War II, Marathi writing was oriented toward the examination of the realities of life and toward experimentation with the use of the living language. Gangadhar Gadgil, Arvind Gokhale, Y. D. Bhavé, and Vyankatesh Madgulkar were active in the short story; and S. N. Pendse in the novel.

See also separate article on **MARATHI LANGUAGE AND LITERATURE.**

Other Indo-Aryan Literatures.—The many literary circles which have sprung up since independence and the number of works which have been published emphasize the growing activity in the other Indo-Aryan languages (Assamese, Kashmiri, Oriya, Panjabi), which hitherto had lagged far behind the pace set by the literatures discussed above.

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DRAVIDIAN LITERATURE

Of the 17 or 18 languages classed as belonging to the Dravidian group, only four—Malayalam, Kannada (Kanarese), Tamil, and Telugu—have been extensively cultivated as literary media. The literatures in these languages, like the other regional literatures of India, are to a great extent derivative in nature, being heavily indebted to Sanskrit for both form and content. The earliest works in all four of these south Indian languages employ vocabularies that contain many words borrowed from Sanskrit, while their motifs can also in large measure be traced to Sanskrit sources, in particular to the great epics, the *Mahābhārata* and the *Rāmāyana*.

While the antiquity of the Dravidian literatures is uncertain, many scholars regard Tamil as having the longest and most nearly independent literary tradition. Malayalam, a comparatively late offshoot of Tamil that developed only after the beginning of literary activity in south India, has the weakest claim to seniority. In their modern phases all four literatures show the steadily increasing effects of contact with Western, particularly English, literature. Among developments of the 20th century are the exploitation of political nationalism as a literary theme and the growth of such literary forms as the drama, the novel, and the short story. Moreover, whereas before the modern period literary works were almost always written in a dialect and style far removed from the ordinary speech of the people, the language of much of the literature written in the 20th century is sufficiently close to the spoken variety to be intelligible to the ordinary reader. At the same time, there has been an increase in the literacy rate and in the number of newspapers and magazines written in south Indian languages.

Tamil Literature.—According to a traditional account, Tamil literature originated as far back as 10,000 B.C., when the first of three successive *sangams* (literary guilds) is said to have been established to foster the production of literary works and to judge their artistic merit. Of the three traditional *sangams*, only the third has a reasonable claim to historical reality, the consensus of informed opinion placing it generally in the first centuries of the Christian era. Many of the classical works of Tamil literature are said to have been written during the period of the third *sangam*.

The earliest known works in Tamil are collections of lyrical and narrative poetry. The lyrical anthologies are eight in number (in Tamil, *Eṭṭutokai*). Most of them deal with love themes, a few describe the virtues incumbent on a good king, and still others are songs in praise of particular men and gods. Another anthology, the *Pattuppāṭṭu* (*Ten Songs*), is more narrative in content. Both the *Eṭṭutokai* and the *Pattuppāṭṭu* are invaluable for the information they provide on the religion, customs, and political and social conditions prevailing at the time of their composition.

In Tamil literature, as in other Indian literatures, works on grammar occupy an honored position. The first grammarian of whom there is any mention is the legendary Agastya, of whose works we may perhaps have a few surviving fragments in the commentaries of later authors. The first Tamil grammar to be preserved intact is the *Tolkāppiyam*, whose actual date of composition is unknown. It is certain, however, that its author, known as Tolkāppiyar, modeled his

work on the Sanskrit grammar of Pāṇini; very possibly he lived sometime during the 5th century A.D. In addition to the matters belonging to grammar as understood in the Occident, the *Tolkāppiyam* contains lengthy expositions on various aspects of literature, including prosody, rhetoric, word usage, and themes treated in poetry. The next major grammatical work is the 15th century *Nannūl* (*Good Treatise*), which still serves as the standard grammar in Tamil schools.

A third type of early writing is exemplified by the *Kural* (literally, couplet), perhaps the most widely known Tamil classic. This is a work of didactic morality whose 1,330 couplets are remarkable for their economy and clarity of style, for the wide range of human situations for which they provide guidance, and for their unique blend of worldly wisdom and idealistic ethics. The *Kural*, or *Tirukkural* (*Sacred Kural*), as it is generally called, inspired many poets to produce similar works. Pre-eminent among these later didactic works is the *Nālaṭiyār*, a collection of 400 quatrains. It shares with the *Kural* a position in Tamil literature that may be compared to that occupied by the King James Bible in English literature, for all three are prized both for their artistic merit and for their religious content.

There is also a class of religious writing which is lyrical and mystical rather than didactic. This body of literature is an outgrowth of the Hindu revivalist movement which arose in south India in the latter half of the 1st millennium A.D. in reaction to the spread of Jainism. Foremost among these Hindu religious lyrics is the *Tiruvāsakam*, a hymn of devotion to Shiva.

The *kāvya* (epic poem) is represented by a number of important works, including the Tamil versions of the *Mahābhārata* and *Rāmāyana*. Other well-known examples of *kāvya* poetry are *Silappatikāram* and *Manimēkalai*, both romantic tales of the adventures of a saintly heroine who, by virtue of miraculous powers and the help of the gods, passes through many trials to attain salvation.

Beginning in the 19th century there has grown up a considerable body of literature written in a prose style that approximates the spoken language and includes plays, novels, biographies, and short stories. In the 20th century there has also been a great increase in the number of Tamil periodicals, and these devote much space to contemporary writing.

Kannada (Kanarese) Literature.—The oldest extant Kannada work is the *Kavirājamārga*, a treatise on poetics written by King Nripatunga (r. 815–877 A.D.). Since it contains references to several older writers, however, the beginnings of Kannada literature must be ascribed to a still earlier period. In the 10th century lived one of the major figures of Kannada poetry, Pampa I, whose chief works are the *Adipurāṇa* and *Vikramārjunaviṣaya*; Chavūṇḍarāya, who wrote one of the earliest known prose works in Kannada, an account of the Jain saints called the *Chavūṇḍarāyapurāṇa*; and Nāgavarma I, who produced the first work on prosody, the *Chhandōmbudhi*. As is true of the other literatures of India, much of Kannada writing in this and later periods is religious in inspiration and sectarian in content.

Among the most important figures in Kannada poetry are Nāgavarma II and Nāgachandra, who lived in the 12th century; Kēśirāja (fl. 13th century), who wrote the best-known Kannada grammar, *Sabdamanidarpaṇa*; and Chikkupā-

dhyāya, Shadaksharadēva, and Lakshmiśa, of the 17th century. Later poets are, in the 19th century, Aliya Lingarāja and Chandrasāgaravarṇi; and in the 20th century, B. M. Srikantia, D. R. Bendre, K. V. Puttappa, and Madhura Chenna. The drama, the novel, the short story, and the essay have all been extensively cultivated since the early decades of the 20th century.

Malayalam Literature.—The earliest extant Malayalam work is the *Rāmācharitram*, attributed to a 13th century raja of Travancore. Prior to that time the literature produced in the Malayalam-speaking part of India was written either in Sanskrit or in Tamil, and even after it had become customary to compose literary works in Malayalam the practice of writing in Sanskrit persisted. Those works not written in Sanskrit very often did not employ a pure Malayalam, but rather a mixture of the two known as *manipravālam* (literally, string of gems and coral). In the period from the 13th to the 16th century a favored type of composition was the song or ballad, frequently either heroic or devotional. A classic work is the *Kṛṣṇagāthā* of Cheruśseri Nampūtiri, written in a simple Malayalam, and thus appealing to a wider readership than the *manipravālam* poetry, which was composed primarily for the learned. An outstanding example of the latter type is the *Chandrotsavam*, an account of a village festival.

Among the more important literary figures of the period from the 17th to the 20th century are Tunchathu Ramanujan Eluthachchan, Kunjan Nampiyar, Kerala Varma Valia Koil Tampuran (d. 1914), Kunhikudtan Tampuran, and Kochunni Tampuran. It was during this period that the two characteristically Malayali art forms were developed: the *kathakali* and the *tullal*. The first is a drama-pantomime in which the verbal text, sung by the musicians, is represented by the gestures, facial expressions, and dance movements of a very few elaborately costumed dancers performing on a bare stage; each action of the dancers has a meaning so precise that the spectator can follow the development of the story even without the vocal accompaniment. The similar *tullal* (literally, dance) is a poem accompanied by music and dancing.

Telugu Literature.—Possibly the oldest extant literary work in Telugu is a version of the *Mahābhārata* begun by Nannayya in the 11th century, almost completed by Tikkana in the 13th century, and finished by Yerrapregada in the 14th century. These three poets are traditionally regarded as the founders of Telugu literature. Other prominent figures of the earliest period were King Nannichoda, who wrote *Kumārasambhavam* (*Origin of the God Kumāra*) under the inspiration of Kālidāsa's Sanskrit *Kumārasambhava*; Palkuriki Somanātha (fl. 12th century), who wrote the first known *śataka* (a set of about 100 verses addressed to some person or god); Śrīnātha (1365-1440), whose works include *Kṛidābhīramam* and *Palnātivīracharitramu*; Vemāna (fl. early 15th century), who wrote widely known *śatakas* which have been translated into English; and Bammēra Potana, who wrote a Telugu *Bhāgavatamu* after a Sanskrit original.

The period from the 16th to the end of the 19th century is noted for the predominance of two literary forms: the *prabandha*, a highly conventionalized epic poem, and the *śataka*. Examples of the *prabandha* are Allasāni Peddāna's *Svārochishamanusambhavam*, the *Vasucharitramu* of

Ramarajabhushana (fl. late 16th century), Nandi Timmana's *Pārijātopaharaṇam*, Krishnadeva Raya's *Amuktamālyadā*, and Tenali Ramakrishna's *Kalāpūrnodayam*. The so-called *prabandha* period lasted until the end of the 17th century, when the *prabandha* gave way to the *śataka*. Much of the *śataka* literature was written during the time when the political power of Andhra (as the land of the Telugu people is sometimes called) was being crushed by the Muslims, and these *śatakas* reflect Andhra reaction to Muslim domination—first despair, and then a spirit of resistance.

The 17th and 18th centuries saw the growth in importance of prose and the drama. The first important work in prose, Raghunatha Raya's *Vālmikīcharitram*, was written in the 17th century, and in the 18th century Kandurti Venkata-chalakavi produced prose versions of several Sanskrit epics. Toward the end of that century appeared the first Telugu novel, the *Rājāśekhara-charitramu* of K. Viresalingam, whose works combine high artistry with a great zeal for social reform. In the drama there were many translations from Sanskrit and English and a wealth of historical, social, religious, and satiric plays. The best-known social drama is *Kanyāśulkam* (*Child Marriage*), by Gurazada Apparao, which ridicules certain traditional Hindu practices.

In the late 19th and early 20th centuries two new kinds of poetry developed: a romantic type inspired by John Keats and Percy Bysshe Shelley, and a poetry of social protest with Marxist overtones. Devulapalli Krishna Sastri, Abburi Ramakrishna Rao, and Rayaprolu Subbarao (1896-) are representative of the romantics, while Sri Sri (pseudonym of Srirangam Srinivasa Rao), Bairagi, and Arudra belong to the school of social realism. Meanwhile, the older tradition of Telugu poetry has been maintained by men like Tirupati Sastri and Venkata Sastri, while Visvanatha Satyanarayana and a few others seek a balance between the classical and the newer poetry.

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FOLK TALES

Much of Indian fiction consists of folk tales—stories collected from oral narration. Since the first volume of such tales, Mary Frere's *Old Deccan Days*, appeared in 1868, many others have been published, sometimes as collections in book form or in periodicals and sometimes as insertions in works dealing with travel, anthropology, religion, or history. Folk tales have come from every part of the country and represent all of the major and many of the minor languages. Some few have been published in their original tongue, but most only in English translation. Narrators have ranged from the completely illiterate to the highly educated. The stories represent all the usual folklore types—cosmogonic, cosmological, and divine myths; place and hero legends; animal stories; tales and adventures; stories of cleverness, stupidity; the marvelous, exaggeration; anecdotes; and jokes. There are long ballads sung or chanted, generally with some simple musical accompaniment, in a public or semipublic setting, and there are simpler and shorter narratives sung in homes or before small audiences. The purpose of a tale may be worship, moral edification, or simple entertainment. Some stories are meant for the nursery; others may be subtle or satirical, appealing to the worldly,

the shrewd, the sophisticated.

Indian fiction illustrates a process of mutual feed and feedback between literature and folklore, both of whole stories and of separate motifs and incidents. A story or a motif may have originated in an illiterate community and have made its way into literature, to exist thereafter in both oral and literary forms. Another story or motif may have appeared first in literature. But in India, which has an extensive and ancient literature as well as a large illiterate population, few stories or motifs have maintained a long uninterrupted existence through oral transmission. Moreover, a story or a motif used in literature often has not remained segregated from folklore. Rather the literary form has often influenced the oral. The oral tradition seems to deteriorate; a story may become thin and ill constructed and waste away into virtual extinction. It may then be refreshed from literature, and studies have shown the direct dependence of many folk tales upon literary forms. Furthermore, many stories or motifs have been planted in the oral fiction from literary sources, sometimes from Indian sources, not always easy to identify, and sometimes from non-Indian sources, especially Persian and Arabic, when the borrowing may be clear. By a reverse process, Indian stories have been transmitted through literature to regions outside India, to become incorporated in the folklore there. Buddhist stories have gone by way of the *Jātaka* collection and other works to Ceylon, Burma, Malaya, Thailand, Cambodia, and Indonesia, and secular tales and Hindu religious legends have gone to some of these regions through such media as the *Panchatantra* (Sanskrit *Pañcatantra*) collection or the Hindu epic *Rāmāyaṇa*. Many have also gone to Tibet, central Asia, China, Iran, and Arabia, and some to Europe. In the regions of India where there is a strong literary tradition, the quality of the oral tales is likely to be better than in those with little or no literary tradition. For example, in the hill regions of Madhya Pradesh, where numerous tales have been collected from peoples whose languages are unwritten, the stories are often poor in plot and detail, while the narrators rarely seem able to sustain a long narrative.

There is much repetition in both oral and literary tales of motifs, themes, and incidents, and it is impossible to separate the one class of fiction sharply from the other. There are a few motifs, such as the life index or life token, which have a wide prevalence in the folklore and yet only rare occurrence in the literature, and a few other motifs and even story types which are limited to one or two peoples, such as the Santals and the Hos, speakers of nonliterate languages, whose dependence upon Indian literature for their fiction is slight. Throughout the areas with literatures, however, there is a great deal of fiction material which is held in common.

See also CHILDREN'S LITERATURE—*Ancient Period* (India); FAIRY TALES; JATAKA; NOVEL, THE—*Narrative Fiction in the Ancient World* (The Orient); RAMAYANA.

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INDIAN LITERATURE IN ENGLISH

With the introduction and spread of English education in India after 1835, many Indians began

to write in English, and while the greater part of creative writing since the mid-19th century has been in the vernacular languages, a considerable body of material in English has accumulated. This material varies greatly in quality, but at least a few Indians writing in English have become masters of style and of their chosen form.

Fiction.—The novel and the short story, both of which have been borrowed from the West, are popular means of expression in India. The Bengali novel *Alāler Gharer Dulāl* (*The Spoilt Child*, 1858), by Piari Chand Mitra, is generally considered the first Indian novel. As in this earliest example, written, according to the author's own statement, to depict the unfortunate results of improper upbringing, many later Indian novelists have been greatly concerned with social problems and have produced works designed to call attention to the need for reform. This has been true of those who wrote in English as well as of writers in the vernaculars, and one of the foremost 20th century Indian writers, Mulk Raj Anand (1905–), falls into this group. His novel *Coolie* (1936) is the story of a young, unsophisticated boy from the hills of north India who makes a bare living in a series of menial jobs until, working as a ricksha puller, he contracts tuberculosis and dies. *Untouchable* (1935) depicts a day in the life of a boy belonging, as the title indicates, to the lowest class of society, while *Two Leaves and a Bud* (1937) deals with the hardships of workers on a tea plantation in Assam.

R. K. Narayan (1906–) is a writer of a very different sort. His aims as a novelist are more purely artistic, and there is nothing of the tract in the series of novels describing the life of Malgudi, a fictional town in south India, and its people. *Grateful to Life & Death* (1953), *The Printer of Malgudi* (1957), and *The Guide* (1958), to name three titles published in the United States, have, with his other novels, won high praise from both Indian and Western critics.

India's struggle for independence, as might be expected, provided the theme for many novels. Of these, one of the earliest written in English is *Kandan the Patriot*, by Kaneripatna Sidhanatha Venkataramani (1891–), a south Indian writer whose inspiration for this novel, published in 1932, was the Gandhian movement. Similarly, *Kanthapura* (1938), by Raja Rao (1909–), is concerned with the effect of the noncooperation movement on the life of a small village. Another writer, Khushwant Singh, in his novel *Mano Majra* (1956), chooses for his scene a village on the border between India and Pakistan and describes events which took place at the time of partition in 1947.

The modern short story finds a ready market in numerous English-language periodicals published in India, and each of the novelists mentioned above has published one or more volumes of stories. With Iqbal Singh, Mulk Raj Anand edited a volume entitled *Indian Short Stories* (1947), which contains some of the best of those written in English as well as translations of stories written originally in the vernaculars. Another short story writer, who is also a poet, Manjeri S. Isvaran (1910–), has vividly portrayed south Indian scenes and characters in a number of collections.

Autobiography, Poetry, and Drama.—Like the novel and the short story, autobiography is a

new literary genre in India. The beautifully written *Autobiography* (1936; new ed. entitled *Toward Freedom*, 1941) of Jawaharlal Nehru (1889–) is outstanding, but other men of renown in politics, religion, science, and letters have also left us records of their life and times. In addition, *The Autobiography of an Unknown Indian* (1951), by Nirad C. Chaudhuri (1897–), is noteworthy, and *The City of Two Gateways* (1950), by Savitri Devi Nanda, presents an interesting account of the life of a young girl growing up in north India.

Among poets who wrote in English, Toru Dutt (1856–1877) and her sister, Aru Dutt (1854–1874), were the earliest to achieve recognition. Their first work, *A Sheaf Gleaned in French Fields* (1876), consists of English translations of French poems. Since both girls died very young, however, their contribution was slight. Sarojini Naidu (1879–1949) is perhaps the most famous Indian poet who chose English as a medium. Her first book, *The Golden Threshold*, was published in 1905, and her third and final book, *The Broken Wing*, in 1917. In later years she devoted her talents to the struggle for independence and won a prominent place in the Indian National Congress. Her work has had considerable influence on younger poets.

Sri Aurobindo (Aurobindo Ghose, 1872–1950), who was known primarily as a religious leader and as the founder of a religious colony in south India, was also famed for his writing. His *Collected Poems and Plays* were published in 1942, and his epic poem in blank verse, *Savitri: A Legend and a Symbol*, in 1950–1951. His poetry is mystical and philosophical, and a number of poets writing in both English and the vernaculars have come under his influence. Of the first group, Dilip Kumar Roy (1897–), a novelist as well as a poet, and K. D. Sethna (1904–) are perhaps the best known.

Indian writers in English have devoted relatively little attention to drama, no doubt because opportunities for production are limited. Besides a few novelists and poets who have experimented with playwrighting, Bharati Sarabhai, who wrote *The Well of the People* (1943) and *Two Women* (1952), deserves mention.

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12. SCIENCE

ANCIENT AND MEDIEVAL PERIOD

There is little Indian scientific or technical literature before the 5th century A.D. which can be dated accurately. But a people capable of making the Iron Pillar of Delhi and the Sultanganj copper colossus of Buddha (c. 400 A.D.), and of hewing out blocks of sandstone 50 feet long and 4 feet square (3d century B.C.), carving them into perfect roundness, giving them a wonderful polish which cannot be duplicated even in the 20th century, and transporting them over distances of several hundred miles, must have attained considerable proficiency in metallurgy and engineering.

The *Kautilya Arthaśāstra*, discovered in 1909, opens up a world of life and thought entirely different from that represented by the religious and philosophical Vedic literature. Kautilya was the prime minister of Chandragupta (r. 321?–?297 B.C.), first of the Maurya emperors, and

his book deals with every phase of government as regulating all matters of worldly life. Sections are devoted to precious stones, ores, metallurgy and mining, roads, trade routes, irrigation, medicine, trees, plants and poisons, ships and shipping, cattle, horses, elephants, chemistry, mechanical contrivances, and other technical matters.

It is probable that only the nucleus of the book can be as early as the 4th century B.C., and that the extant work is a composite based on the tradition of a school. No one, however, has argued for a date later than the 4th century A.D. for any part of it.

We now know that the Hindus were one of the greatest navigating and colonizing peoples of antiquity. At least from the 1st century A.D., and probably from three or four centuries before that time, Indian culture was the dominant factor throughout Indochina from Burma to China and in the islands from Sumatra and Java to the Philippines.

Language and Grammar.—The work of the Hindus on the systematic analysis of language reached a much higher point than that of any other people of antiquity. The grammar of Pāṇini (fl. probably not later than 500 B.C.) is the earliest scientific grammar in the world and one of the greatest ever written. It was the discovery in the late 18th century of Sanskrit and the Indian methods of analyzing language that revolutionized the Western study of language and led to the modern science of comparative philology.

The most striking feature of Sanskrit grammar is its objective resolution of speech and language into their component elements. Long before Pāṇini, who names over 60 predecessors, the sounds represented by the letters of the alphabet had been arranged in a systematic form, and the sounds in each group had been ordered according to the places in the mouth where they are produced. Words were analyzed into roots, from which complete words grew by the addition of prefixes and suffixes.

The study of language in India was as objective as the dissection of a body by an anatomist. It would be strange if this empirical attitude had been confined entirely to linguistics.

Geometry.—Undoubtedly the oldest works of Indian mathematics are the *Sulvasūtras* (Sūtras of the cord), which form part of the Vedic *Kalpasūtras*. While these texts are primarily geometrical, they seem to indicate the beginnings of mathematics. They deal with the building of altars and sacrificial places, and discuss such matters as the construction of squares and rectangles, the relation of the sides to the diagonals, and the construction of equivalent squares and rectangles, equivalent circles and squares, triangles equal to squares and rectangles, and squares equal to two or more given squares or to the difference of two given squares.

Although the date of the *Sulvasūtras* is unknown, it is probable that they were written as early as the 3d or 4th century B.C. Moreover, altars and sacrificial places of the same shape and construction are described in the much older Vedic literature. None of their geometrical constructions occur in later Indian texts, nor did they have a formative influence on the further development of geometry. The Vedic sacrificial ritual was replaced by temple worship, and later development was along the lines of arithmetic and algebra.

Hindu-Arabic Numerals.—From a very

early period the people of India were preoccupied with problems involving numbers, and they soon developed names for classes of numbers mounting by powers of 10. Such enumerations led more easily to the discovery of place value than the clumsy Roman method or the Greek method of counting by myriads. By the 5th century A.D. calculations were made by means of nine numerical symbols, with or without a sign for zero. These were used with place value so that they sufficed for the expression of all possible numbers. In the scanty Indian inscriptional material the earliest certain use of a symbol for zero appears in the 9th century, and symbols for the other nine numerals occur a century or two earlier. Their employment in inscriptions in Indochina goes back to 604 A.D., however, and their usage there doubtless was derived from India.

Since most of the early literature and inscriptions were written in verse, symbols could not be used, and numerical words were employed. *Sūnya*, meaning "empty" or "vacant," was used to indicate a vacant place in the numeration. Later a symbol, a dot or small circle, was used instead. About 800 A.D. the Arabs translated the word by *sifr* (vacant), and this later developed into the English cipher or zero.

In two Sanskrit texts of the early 6th century A.D., the *Sūryasiddhānta* (i, 29) and the *Brhatsamhitā* of Varāhamihira (viii, 20), words were used in place of numbers and were given in a definite order so that the numbers denoted by the words would be applied from right to left. The *Yogabhāṣya* (iii, 13), also of the 6th century, says, "Thus the same stroke is termed one in the unit place and ten in the ten's place and a hundred in the hundred's place." Surely a system with place value is implied. Brahmagupta (fl. early 7th century) gives rules for arithmetical operations with zero, as does Varāhamihira (b. 505?). In Subandhu's *Vāsaavadattā* (early 7th century) is the statement that the stars in the sky are like zeros put there by the Creator to indicate the nothingness of this world of transmigration.

The use of a symbol for zero may be later than that of the other nine symbols. Perhaps a board divided into perpendicular columns was used, the columns having the place value of units, tens, hundreds, thousands, and so on. After the discovery of place value either such a board with columns or a sign for zero would be necessary.

The forms of the numerals which we use today and call Arabic numerals were learned by the Arabs from India in the 8th century, but a passage from the Syrian Sēbōkt (662 A.D.) furnishes the earliest known reference outside India to Indian numerals: "The subtle discoveries of the Hindus . . . their clever method of calculation, their computation which surpasses words, I mean that which is made with nine signs."

Arithmetic and Algebra.—The classical period of Indian mathematics begins with Āryabhata (b. probably 476 A.D.) and extends to Bhāskara (b. 1114). Āryabhata's section on arithmetic culminates in the general solution in whole numbers of indeterminate equations of the first degree. Of Bhāskara's cyclic method of solving indeterminate equations of the second degree, Hermann Hankel, the well-known historian of mathematics, remarked that it was the finest thing in the theory of numbers before Joseph Louis Lagrange in the 18th century. In algebra the Hindus went

beyond the Greeks, and there is no proof of foreign influence on Indian mathematics.

The Hindus developed the sine function in computations connected with angles and with the circle. While the Greeks used a trigonometry of cords (the ratio of the cord to the diameter), the Hindus considered the ratio of the half cord to the radius a fundamental, and modern trigonometry rests on this foundation. The word *jyā* or *jīva* was first used by Āryabhata. Abbreviated from *ardhajyā* or *ardhajīva* (half cord), it means "bowstring." It was transliterated into the meaningless Arabic *jiba*, whose consonants allowed later writers to substitute the word *jayb*. This was subsequently translated into Latin as *sinus*, from which the word *sine* is derived.

Astronomy.—Classical Indian astronomy is now only of historical interest, although there seems no doubt that it exercised a formative influence on early Arabic astronomy and therefore had some effect on the medieval astronomy of Europe. In the astronomical literature of the third period, which begins at the latest in the 5th century A.D., the earth is described as a motionless globe of which Mount Meru is the axis, and around which the sun, moon, five planets, and the other heavenly bodies revolve. The sun, moon, and planets move more slowly than the stars and therefore change their places in relation to them. The true places of the planets in relation to their mean places are calculated by means of epicycles. The inclination of the ecliptic to the equator is known, and the positions of the heavenly bodies with reference to both are calculated. The procession of the equinox also is known. Moreover, the real cause of eclipses of the sun and moon is recognized, and the relations of these bodies are so well known that eclipses are calculated with great accuracy. The sexagesimal division of the circle is used. Substantially, this represents the point reached in Greek astronomy by the time of Ptolemy (2d century A.D.).

The system of the *Sūryasiddhānta*, the only one of five old Indian astronomical works to be preserved, was continued in approximately the same form from Āryabhata to Bhāskara. During this entire period there was little development in theory, the method of calculation continued unchanged in essentials, and only minor corrections in the numerical elements were made. Noteworthy is the assertion of Āryabhata that the earth rotates on its axis, but this theory remained isolated and was not followed by later works.

It is uncertain how much of Indian astronomy was original and how much was borrowed from the Greeks. Greek influence on Indian works of astrology is undeniable, and some words of Greek origin are found in later Indian works on astronomy. Of these the most significant is *kendra* (Greek *kentron*, center), since the center of the epicycle coincides with the mean place of the planet.

Medicine.—The beginnings of Indian medicine can be traced back to the magical charms of the Atharva Veda, but classical Indian medicine dates from Charaka and Suśruta (somewhere between the 1st and 4th centuries A.D.). The works of both were translated into Arabic about 800 A.D. While Charaka is essentially medical, Suśruta deals primarily with surgery. The osteology of these texts proves that careful empirical observations must have been made. Suśruta remarks: "No accurate account of any part of the body, including even the skin, can be rendered

without a knowledge of anatomy. Anyone who wishes to acquire a thorough knowledge of anatomy must prepare a dead body and carefully examine all its parts. For it is only by combining ocular observation and the information of text-books that thorough knowledge is obtained." He continues with considerable detail concerning methods of procedure. There is no trace of Greek influence on Indian medicine.

Theology and systems of abstract philosophy submerged the further development of a scientific attitude of mind in India until modern times.

See also 10. *Linguistic Science*; 11. *Literature*—*Classical Literature*; and separate articles on ALGEBRA—1. *History* (India); SURGERY—*Early History*.

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MODERN DEVELOPMENTS

The introduction of English education in the 19th century marked the beginning of a scientific revival in India. From 1855 onward arrangements were made for the teaching of science in the newly established schools and colleges. After the passage of the Universities Act of 1904, Indian universities were enabled to provide laboratory facilities and staff for science teaching, and progress in all sciences became noticeable.

Science Revival.—The revival of interest in science was given impetus by the efforts of such learned societies as the Asiatic Society in Calcutta, scientific surveys, and government scientific officers. The pioneering work of the four government survey departments helped to lay the foundations for the development of science. The Trigonometrical Survey, renamed the Survey of India (1878), was responsible for mapping the subcontinent; the Botanical Survey (1889) and the Zoological Survey (1866) embarked on an appraisal of Indian flora and fauna; and the Geological Survey of India initiated an assessment of mineral resources.

By the beginning of the 20th century many Indian universities had developed postgraduate departments in various sciences. The government of India established research institutes, among them the Imperial Agricultural Research Institute, Pusa; the Central Research Institute for medical research, Kasauli; and the Forest Research Institute, Dehra Dun. In addition, the provinces started institutions for medical and agricultural research, and private benefaction was responsible for the Indian Institute of Science in Bangalore, the Indian Association for the Cultivation of Science and the Bose Research Institute in Calcutta, and other institutions.

The early decades of the 20th century witnessed the formation of scientific societies. The Indian Science Congress Association (1914) provided a forum for research workers from various parts of the country. Three national academies—the National Institute of Sciences of India, the Indian Academy of Sciences, and the National Academy of Sciences—came into being in the 1930's.

The first half of the century was also notable for achievements by individual scientists, like those of the great mathematical genius Srinivasa Ramanujan (1887–1920); Sir Venkata Raman (1888–), whose name is associated with the Raman effect; and Sir Jagadis Chandra Bose (1858–1937), whose studies on plant life opened a new trail. The pioneering work of Sir Ronald

Ross (1857–1932) on malaria and the contribution of Birbal Sahni (1891–1949) to paleobotany also merit mention.

Science and the Nation.—Important as these developments were, scientific research in India had hardly any impact on national development. Research was mainly academic and largely the concern of the talented few in universities and research institutions. While some attention was paid to the improvement of primary products, the emphasis was on raw materials with export potential. The exigencies of two world wars and the dawn of independence changed the picture entirely. A proper appraisal of the scientific resources of the country vis-à-vis national needs was then taken up. The lacunae in the research effort were sought to be filled, and attempts were made to establish viable organizations for promoting research. The tempo of technological education was accelerated, and institutes with postgraduate facilities for research in engineering and medicine came into being.

There are three autonomous all-India councils, each with its network of laboratories and stations, dealing with problems of research and development: the Council of Scientific and Industrial Research, the Indian Council of Agricultural Research, and the Indian Council of Medical Research. The Atomic Energy Commission is concerned with research and development of nuclear energy, and responsibility for research in the defense field vests in the Defence Science Organization. Moreover, technical departments under the various ministries contain research divisions. Among other institutions, mention may be made of the Indian Bureau of Mines, the Oil and Gas Commission, and the Indian Standards Institution.

Rapid developments under the national five-year plans have imposed new responsibilities for intensifying scientific effort. A scientific policy resolution passed by the Indian Parliament in 1958 accepted these responsibilities and assured continuing support for scientific inquiry.

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13. RELIGION AND PHILOSOPHY

There are no major variations of belief, practice, or history within each religion of the Indian subcontinent based upon geographical differences. For this reason, the religions of India and Pak-

RELIGIONS OF INDIA AND PAKISTAN

Religious group	India ¹	Pakistan ²
Total population	356,879,394	75,636,000
Hindus	303,186,986	9,770,000
Muslims	35,400,117	64,959,000
Christians	8,157,765	541,000
Sikhs	6,219,134	...
Jains	1,618,406	...
Buddhists	180,767	319,631 ⁴
Parsis (Zoroastrians)	111,791	5,435 ⁴
Jews	26,781	...
Tribal	1,661,897	30,278
Nontribal; others	47,148	11,712 ⁴

¹ Source: *Census of India, 1951*, Paper No. 2, 1953, *Religion*, Table D-II. The census did not include Jammu and Kashmir and certain tribal areas of Assam, whose combined population is estimated at 4,971,000, and the figures for religion also exclude 268,602 persons in the Punjab whose records were destroyed by fire before the information on religion could be tabulated. Many persons counted in the previous censuses as animists were returned in 1951 as Hindus or Christians. ² Source: *Census of Pakistan, 1951*, vol. 1, Table 6, Religions. The total excludes 207,000 persons not of Pakistani nationality. ³ Not differentiated. ⁴ Corrected figure.

istan are treated together under the following headings: (1) religion and philosophy of Indian origin, (2) Islam, and (3) Christianity. The religious distribution of the population of the two countries is shown in the accompanying table. About 20,868,000 of India's Muslims live in the northern and eastern region of the country, and about 9,239,000 of Pakistan's Hindus live in East Pakistan.

For the religion of the Parsis of the subcontinent, see **MISSIONARY MOVEMENTS—Zoroastrian Missions**; **PARSIS or PARSEES**; **ZOROASTRIANISM**.

RELIGION AND PHILOSOPHY OF INDIAN ORIGIN

Modern Hinduism and Brahmanism.—Hinduism is more than a religion: it is a total way of life, including social order, law, science, literature, art, and philosophy as well, for in India philosophy and religion have never existed separately from each other. Incorporated in it is the body of Indo-Aryan thought and ritual cultivated by the learned class called Brahmins (*Brāhmaṇa*) and stemming from the Veda, but altered and expanded in post-Vedic times as the Aryan invaders of India blended with the non-Aryans whom they met there. This constitutes the "higher" religion called Brahmanism. It is contrasted with a mass of belief subliterate in origin and coming from all the racial and cultural elements known to have existed in India. This is the "lower" religion or popular Hinduism.

Beliefs.—Hinduism countenances every shade of theological belief, starting at the bottom with the most naive form of animism, passing through polytheism and monotheism, to reach at the top a rigorous philosophical monism. It has no formal creed, no standardized cult practice, no controlling ecclesiastical organization. Its adherents usually ascribe incontrovertible authority to the Vedas, but refer to that ancient collection less frequently than to later texts. For theology and mythology they rely upon the two great Sanskrit epics, the *Mahābhārata* and the *Rāmāyana*, which grew up slowly between 400 B.C. and 400 A.D., and versions of them in modern vernaculars, such as that in Hindi by Tulsī Dās (1532-1623); the *Purāṇas* (also in Sanskrit), the most important of which were probably composed between the 6th and 13th centuries; and a class of texts called *Māhātmya* (usually recent works, generally in Sanskrit), which purvey local religious legends. For cosmogony and cosmology they accept the statements of the *Purāṇas*. For religious law they refer less to the oldest legal textbooks called *Sūtras* (thought to be from before the 4th century B.C.), which are closely attached to the Vedas, than to the later (2d to 7th century A.D.) *Shāstras* (*Sāstra*). In cult practice they do not employ the old and elaborate fire and soma rites of the Vedic ritual texts known as *Brāhmaṇas* (10th to 7th century B.C.), but use an infinite variety of later-developed ceremonies.

To some Hindus all phenomenal existence is only relatively real—these are adherents to pure monism. Others may accept much simpler concepts. Probably the greatest number of those who recognize authority in the Hindu scriptures accept in some form, though often with considerable modification, the theory of the *Purāṇas* concerning the recurring dissolution (*pralaya*) of the universe and its re-creation (*pratisarga*). The elements of the universe are matter (*prakṛti*; Sanskrit *prakṛti*), which has three qualities

(*guna*; Sanskrit *guna*), namely, goodness (*satva*), passion (*rajas*), and darkness (*tamas*). Against matter is contrasted spirit (*puruṣa*; Sanskrit *puruṣa*). From these, under impulse from the self-existent *Brahmā* (masculine), who is sometimes equated with matter or spirit or with both, evolve all the gods, all other animate creatures, the earth, the heavens, the hells.

Conceptions of deity also vary. On medium and high intellectual levels Hindus are almost always adherents of sects or cults devoted either to the great deities Shiva (*Śiva*) and Vishnu (*Viṣṇu*) or to lesser deities associated with them. Vishnu may be worshiped in his incarnations (*avatāras*; Sanskrit *avatāra*), of which the two most popular are Rāma Chandra, hero of the *Rāmāyana*, and Krishna (*Kṛṣṇa*), speaker of the religious lyric *Bhagavad Gītā* and hero of a large body of legend centered at Mathura. Vishnu's wife, Lakṣmi (*Lakṣmī*), is also honored as the goddess of prosperity; in the Krishna legend she is incarnated as the milkmaid Rādhā, Krishna's mistress. Another favorite is Hanumān, the monkey god who in the *Rāmāyana* helped Rāma rescue Sītā, Rāma's wife, whom the demon Rāvaṇa had abducted to Ceylon. Shiva is often worshiped as the phallic symbol (*linga*; Sanskrit *linga*), with which may be associated the female symbol (*yoni*) as the emblem of his wife, Pārvatī. His sons Kārtikeya or Skanda (god of war) and Ganeśa (*Gaṇeśa*), the elephant-headed god who removes obstacles and brings good fortune, are popular deities. Sectaries often wear distinguishing marks on their foreheads. Sectarian adherence, though sometimes polemical, need not be very strict, and a Shaiva (*Śaiva*, one belonging to a Shiva sect) may on occasion worship in a Vaishnava (*Vaiṣṇava*, belonging to a Vishnu sect) temple and vice versa.

A variation of Hinduism is adoration of the female principle or power called Shakti (*Śakti*), represented as a goddess. As the creative and effective energy in the universe, this is considered by devotees to be more important than the male principle, represented as a god, which is otherwise only unrealized potentiality. This type of worship, a variety of Tantrism (its texts are known as *tantra*), is directed toward Devī, meaning "goddess," the wife of Shiva, and otherwise called by such names as Umā, Pārvatī, Durgā, Gaurī, Bhavānī, Kālī, and Ambikā. She is the universal mother. Shaktism is either right handed or left handed, the chief distinction lying in the use of ritual by the latter group which involves erotic and magic practices.

On lower intellectual levels, Hindus may propitiate any of a large number of vegetation and fertility godlings, divinities of disease or misfortune, the village mother goddesses, ancestral spirits, the sun, and the moon. Trees, such as the variety of fig known as pipal, and stones may be treated as sacred; also animals, such as the monkey, the peacock, the cobra, and, in some cases, the tiger and the horse. Rivers, such as the Ganges, the Jumna, the Narbada, the Godavari, the Krishna, and the Kaveri, may be holy, and so, too, mountains, such as the Himalaya and the Vindhya Range. Astrology, divination, and the use of omens are common; the evil eye is feared.

On the highest intellectual level a Hindu seeks the one reality, whether conceived impersonally as Brahma (neuter) or theistically as Shiva or Vishnu. Once he succeeds, he may continue to live in the world but without emotional attachment

to it; it no longer has significance for him. He has passed above all the opposites—sorrow and joy, pain and pleasure, evil and good.

Hinduism accepts as not requiring proof the joint doctrine of rebirth and works (karma). Every living being at the time of death is reborn in a different form, either higher or lower, whether as a human being, an animal, a heavenly creature, or a hell dweller. From that existence it will again be reborn, and so on endlessly. This round of rebirth is called the *samsara* (Sanskrit *samsāra*). The precise form of each rebirth is always determined by the balancing, as in a mathematical equation, of the being's deeds (karma) in previous existences. Escape from the cycle of rebirth constitutes salvation—*moksha* (Sanskrit *mokṣa*), *mukti*, *nirvana* (Sanskrit *nirvāna*)—and is in theory the ultimate goal of every living being, but it is so difficult to attain that the aim is almost invariably only to improve one's condition in the next existence. Rarely does anyone strive for more than a long life, perhaps lasting a few million or billion years, in the heaven of some god. A being who attains salvation may do so through perfect performance of ceremonial works (karma), that is, ritualism; or through attainment of perfect knowledge (*jñana*; Sanskrit *jñāna*), essentially a philosophic goal, toward which the greatest help is the practice of meditation with the aid of the technique known as *yoga*; or through some deity's grace won by the worshiper's complete and loving devotion (*bhakti*); or by the prosecution of severe asceticism (*tapas*). In every case, strong emphasis is laid upon having a guru (spiritual preceptor), who may be viewed as little less than God.

Worship.—Places of worship range from the most primitive of wayside shrines, consisting of a stone set under a sacred tree and daubed with paint, symbolizing some form of divinity, to the most elaborate complex of structures constituting an enormous temple. Certain cities are especially holy to Hindus, the most holy being Varanasi (Banaras). Hindus use images freely in their worship as comprehensible symbols of a deity which in its true form is not apprehensible by human senses, though for the unsophisticated the use may be only that of idolatry. Worship may consist of offerings of flowers, fruit, grain, ghee (Hindi *ghī*, clarified butter), money, and, in some connections, animal sacrifice. A worshiper may appeal to the deity directly or through the agency of a priest. Worship is usually individual; an exception is the chanting of religious lyrics by a group under the stress of devotional emotion. In the temples ritual may be elaborate, involving the use of Sanskrit verses recited by scholarly priests, but many village priests know no Sanskrit and confine themselves to the use of vernaculars.

Religious authority vests in the Brahmins, who besides being custodians of the sacred learning constitute the priesthood. They officiate at religious ceremonies in homes or temples and are other men's vicars in dealing with the deities. As astrologers they cast horoscopes and then interpret them throughout a person's life to determine auspicious and inauspicious moments and conditions for specific undertakings.

Caste System.—The social structure of Hinduism is embraced in the caste system, which separates mankind into many separate groups. The word *caste* is a modification of the Portuguese noun *casta*, meaning "[pure] race or lineage," and is derived from the Latin adjective

castus (pure); the Indian term is *jāti* (Sanskrit *jāti*), meaning "group by birth." The various castes have different social precedence. At the top are the Brahmins, in traditional law constituting a highly privileged group, who have been the codifiers and formulators of the philosophy sanctioning the system and the directors of the instrumentality for enforcing its rules. They constitute about 7 per cent of the Hindu community. Caste is hereditary, and it is not possible to transfer from the caste in which one is born to another. Neither can a non-Hindu individual ordinarily become a member of a Hindu caste, though under certain conditions a group can slowly enter the system as a new caste.

The caste system prescribes strict regulations concerning marriage, which must usually be within the caste but outside the immediate family or clan; eating, which is subject to taboos and complicated rules respecting the acceptance of food and drink from members of other castes; and many other phases of human relationship. In its most extreme form it has imposed onerous disabilities upon those lowest in the scale, known as *Fifths*, who are estimated to comprise 20 per cent of the Hindu community. Traditionally these people performed the most degrading forms of work. They were held to pollute the higher castes through mere proximity and were required to live in separate quarters or in separate villages. Frequently they were denied access to wells, roads, schools, and temples used by the higher castes, and were forbidden by religious law to read or hear the recitation of the scriptures. In the 20th century these taboos, restrictions, and impositions have been greatly eased.

In Hindu theory each caste has a separate social function or occupation, but in practice the rule does not hold. Since the criteria are not sharply separated, the number of castes is impossible to determine. Endogamous groups of more than 500 members each probably exceed 1,000 in number, but most of these are of only local provenience. The castes are classified by the Hindus in five groups—in descending order of social worth. Brahmins, Kshatriyas (*Kṣatriya*) or Rajanyas (*Rājanya*), temporal rulers, and Vaisyas (*Vaiśhyas*; Sanskrit *Vaiśya*), commons (that is, merchant and artisan groups) are called twice born (*dvija*), because the boys in these three groups undergo a ceremony of initiation, whereupon ideally they enter upon their religious training. The two other groups are Sudras (*Shudras*; Sanskrit *Śūdra*), servants; and Pan-chamas (*Pañcama*, fifth) or outcastes, also known eclectically as untouchables, exterior castes, scheduled castes, depressed castes, pariahs, or, in Mohandas K. Gandhi's term, *Harijan* (God's folk). The last two groups have no ceremony of initiation; most of them are descendants of lowly groups that at one time or another achieved a place in Indo-Aryan society and religion. The fivefold classification also breaks down, since a caste may in one census assign itself to one of these groups but in the next to the group higher. Every caste, no matter how low in the scale, always knows another which it considers lower.

Ethics.—Man's duty (*dharma*) is to satisfy his caste rules and fulfill his caste functions, to honor the gods, to observe the ceremonies which ideally accompany every important aspect of life from conception to after death, and to perform miscellaneous good works, such as almsgiving, the undertaking of vows and pilgrimages, often

at specified times when great numbers of people gather in festivals, religious bathing, reverencing the Brahmans, and feeding the poor. In Hindu teaching from the time of the Sūtras, a man devoted most fully to religion should divide his life into four periods or stages (ashrama; Sanskrit *āśrama*): (1) celibate studentship (*brahmachārin*); (2) householder (*grhastha*), raising a family and fulfilling his worldly duties; (3) forest-dweller anchorite (*vānaprastha*), retiring with his wife to a remote place for religious duties and meditation; and (4) wandering ascetic (*sannyāsin*, *bhikṣu*), having severed all ties with family, living alone, subsisting on alms. This fourfold scheme is but rarely practiced today.

The outstanding ethical principle is ahimsa (Sanskrit *ahimsā*) or noninjury of living creatures, which Gandhi called nonviolence. The doctrine applies not only to mankind, but also to the animal world, varying in application toward the separate animal species but always demanding protection of bovines, which hold a position of peculiar sanctity in Hinduism. Acts violating one's duty constitute offenses against religion and may even be attended by ceremonial pollution. This may be absolved by paying penalties or by performing expiatory rites.

Hinduism has been an incorporating religion, accepting and legitimizing ideas, deities, and cult practices from many sources. It blends its widely varying beliefs and practices into a whole by admitting, without explicit statement, that men are not intellectually and spiritually equal. For this reason, it is unrealistic to expect all human beings to believe alike, pursue the same goals, have identical behavior, attain the same spiritual heights. Truth has one aspect to one person, another aspect to a second person, and still another to a third. Absolute truth can be achieved by only the rarest individual, but what any man sees is, within his limitations, truth for him. Similarly, man's conduct is governed by rules that vary according to his spiritual and intellectual capacity. In this relative view of life lies the sanction for the caste system. A person is born to the status that suits his attainments in consequence of his deeds in previous existences; the functions of that status are those which he should fulfill—he should not try to fulfill those of some other status, says the *Bhagavad Gītā*, even though he might perform them better than the person to whom they belong. The code of personal conduct under which he lives is the one suitable to his status and to him. A consequence of this view has been that in Hindu thinking there has been little concern about human rights; rather the emphasis has been put upon the fulfillment of duties.

The Hindu system is, therefore, marked with a high degree of tolerance and flexibility, and is capable of relatively easy adaptation to changed living conditions. Thus, caste rules may alter rather quickly. Early marriage of girls no longer is binding, and the seclusion of women is outmoded. Even the remarriage of widows has gained some degree of toleration. Though many detailed features have been altered in the 20th century, it would not be justifiable to assume that Hinduism as a system is vanishing. It has been strong enough in the past to persist in spite of many changes induced by intellectual or social pressures developing from within or by forces imposed upon it from outside. There has never been a time in the known history of Hinduism when it was not altering in some important re-

spect. Modern reforms are the 20th century illustration of an old and recurring phenomenon.

See also 5. *Way of Living—Caste*; 14. *Law*; and separate articles on BRAHMA; BRAHMAN; BRAHMANISM; CASTE; HINDUISM; KRISHNA; LAKSHMI; SIVA or SHIVA; VISHNU; other major deities.

Early Indus Civilizations.—Inferences concerning the religion of the prehistoric early Indus civilization are drawn from sculpture, pottery figurines, seal designs, and other finds, especially of the Harappa period (c. 2500–1700 B.C.). The data give presumptive evidence of worship of a god who had characteristics similar to those of Shiva in historic times, of a cult of the Great Mother or Earth Goddess, and of phallic worship. Certain trees appear to have been sacred, including the pipal tree, which is sacred in Hinduism today. In some representations trees have associated with them female figures that may be fertility divinities. Various animals, including the tiger, elephant, buffalo, crocodile, rhinoceros, and mythical hybrid creatures, appear to have had sanctity. Symbols appear which reappear in historic India with religious significance, among them the swastika.

See also 16. *Prehistory*.

The Vedas.—India's earliest book, the Rig Veda (*Rgveda*), which was probably compiled by 1000 B.C., consists of 1,028 hymns composed by sages (*rishi*; Sanskrit *ṛṣi*) for use in the religious ritual of the early Indo-Aryans. Accompanying it and of almost equal antiquity are three other compilations: the Yajur Veda, which preserves the prose formulas used in early Vedic ritual; the Sāma Veda, which deals with the chants belonging to it; and the Atharva Veda, which provides for the private or household religion.

The religion of the Rig Veda derives in part from primitive Indo-European times, as in addressing the deified Sky Father, Dyaus Pitṛ (for etymology and meaning compare Greek Zeus Pater, Latin Jupiter), and the Earth Mother, Pṛthivī Mātṛ (for significance compare Greek Demeter, Latin Terra Mater). The most prominent deities and ideas in the Rig Veda, however, cannot be identified as primitive Indo-European. These include a class of superhuman beings known as asura, some of whom, the Adityas—Varuṇa, Mitra, Aryaman, Bhaga, Dakṣa (Dakṣa), Aṁśa—are benevolent, others of whom are malevolent, being demons (*rakṣas*). The chief god of the Vedic pantheon, Indra, is also hard to associate with any Indo-European figure. Because of his pre-eminence he is often called the sole (that is, supreme) god. Some of the Vedic mythic material associated with the asuras and Indra seems similar to items appearing earlier in the mythology of the Mesopotamian-Iranian region, through part of which the Aryans passed on their way to India.

The Rig Veda presents the universe as being in two main parts. One is that which men and gods inhabit; it contains light, heat, and moisture and itself has three parts, namely, the surface of the earth, the atmosphere, and the vault of heaven. This is called the sat (existent). The other main part is a place of darkness and horror called the asat (nonexistent), where demons lurk by day and whence they emerge by night. The central theme of Vedic mythology is the conflict between Indra, the champion of the gods and their king, and Vritra (*Vṛtra*, the encloser), personification of the hard covering within which

were originally contained the elements needed for creation of the sat. Vritra is usually described as a serpent, the malevolent leader of the demons. Indra slew him with his weapon (vajra) or, as is frequently said, burst open his belly. Out flowed the waters (*āpas*), often described complementarily as cows, to fill the celestial ocean. Marvelously they were pregnant with the sun. The universe now had moisture, light, and warmth, and creation could take place. Order (*rita*; Sanskrit *ṛta*) was established and put under the administration of Varuna, and in due time man was created. Every creature—man or god—had a personal function to fulfill as part of order. When he fulfilled it, he was living in accord with the sat and so achieving his highest good.

The Vedic cult centered about the fire sacrifice, which was personified as Agni, god of the sacrifice and the divine priest. Offerings included animals and ghee, but the most important was soma, an exhilarating drink pressed from some unknown plant and personified as the god Soma. The fire ceremony required an elaborate priesthood to summon the gods, recite the appropriate stanzas or prose formulas, sing the chants, perform the manual acts, offer the prayers, and direct the ritual. This priesthood was of prime importance, since the ritual was useless if not executed perfectly, and it was the origin of the Brahman caste.

Men and gods were mutually dependent: men sought prosperity, lineage, health, long life, victory in battle, and safety from demons, all of which the gods could provide; and the gods needed for their sustenance the rich offerings made in the sacrifice. The righteous dead, those who by their religious observances had won the favor of the gods, went to the realm of the blessed, where lived Yama, the first man, to rejoice there with him and the gods. On the way they were protected from the demons by the two heavenly dogs, Śabala (brindled) and Śyāma (dark). The wicked, however, had no such protection, but, fettered by their sins, were waylaid and overtaken by the demons and destroyed.

As the sacrifice became increasingly important and complex, various schools of priests arose for preserving its ritual, and these put their teachings into the form of literary works known as the Brāhmaṇas. The sacrifice itself came to be considered all powerful, operating mechanically as a kind of cosmic magic which, when properly performed, could compel even the gods to the sacrificer's will. Contemporaneously there also developed an interest in cosmogony outside the sphere of the Indra myth, and various explanations of the origin and operation of the universe are advanced. A kind of superdeism appears, centering around Prajāpati (lord of creatures). Or a world man, Puruṣa (*Puruṣa*, male), when sacrificed, provides the material of the universe. The sounds of the sacrifice, consisting of the crackling of the fire regarded as the voice of Agni and the chants of the priests, are viewed as all controlling; this idea appears as the feminine deity Vāc (voice). A strictly impersonal conception appears with respect to the idea of Tad Ekam (sole principle; neuter), from which all is evolved. These various speculations record the beginning of Indian philosophy.

See also BRAHMANAS; INDRA; VEDIC LITERATURE.

Upanishads.—The Upanishads (*Upaniṣad*), probably beginning in the 7th or early 6th century

B.C., which appear as appendages to the Brāhmaṇas, extend the tentative Rig Vedic philosophical inquiries about the nature of the universe and in addition investigate the human psyche or soul. They do not develop these topics systematically, and the explanations offered in different Upanishads are not all mutually consistent. A frequent form of Upanishadic investigation starts with the conception of sleep and develops the idea of the four states of the soul: the waking state, dreaming sleep, deep (dreamless) sleep, and the fourth state (*turiya*), indescribable in terms of the senses, which is conceived as the final goal in man's search for the ultimate. Other passages teach that the soul is immanent in all creation, uniform in character, and the essential part of the individual. As described by the celebrated teacher Yājñavalkya, it is pure subject, distinct from all that is material, unknowable, capable of perceiving and of knowing all, yet unmatched by any second reality to be perceived or known. All else but soul is only relatively real. Duality is in the final analysis false; ultimate truth lies only in a monistic conception of the universe.

The identification of the human soul (*atman*; Sanskrit *ātman*) and the universal soul (*brahman*) on these terms is the supreme achievement of the Upanishads. Besides this monism, however, some Upanishads also express the view that both matter (*prakṛiti*) and soul (*puruṣa*) are real, being mutually exclusive and standing in complete contrast to each other. Both views have since persisted in Indian thinking, appearing in one form or another in the various philosophical and religious systems.

In the Upanishads appear the first suggestions of the doctrine of rebirth (metempsychosis; transmigration of the soul) and retribution for one's deeds (karma) in succeeding existences. The Upanishads also speak of engaging in meditation with the aid of yoga.

Much religio-philosophical speculation and doctrine appear in the great epic *Mahābhārata*, most conspicuously in the section known as the *Bhagavad Gītā*, which calls itself an Upanishad. Krishna, who is an incarnation of the god Vishnu, instructs Arjuna, leader of the army fighting for the right, and though admitting the approach to self-realization through works, provided they are performed selflessly, and through knowledge, emphasizes above all loving devotion (*bhakti*) to God. In the climax of the work, Krishna reveals himself in transfigured form as Vishnu, containing within himself the universe.

See also 11. Literature—Classical Literature; and separate articles on BHAGAVAD GITA; MAHABHARATA; UPANISHADS.

Formal Philosophies.—In the period of approximately 1,000 years from the time of the older Upanishads, or roughly from around 500 B.C. to 500 A.D., the six orthodox systems (*darshana*; Sanskrit *darśana*, view) of Indian philosophy were developed and given their classical form. These systems, which provide the intellectual basis for Brahmanic Hinduism, are (1) Pūrva or Karma Mīmāṃsā, "discussion of the first, or practical, part" of the Vedic religion; the formulation of its basic text is ascribed to Jaimini; (2) Uttara Mīmāṃsā, "discussion of the latter part" of the Vedic religion, often called Vedānta (end of the Veda); the formulation of its basic text is ascribed to Bādarāyaṇa; (3) Nyāya, "logical method," formulated in a text by Gotama (Gautama); (4) Vaiśeṣika, "differenti-

ation," the philosophy of atomism, ascribed to Kaṇāda; (5) Sāṃkhya, "reason" or "enumeration," which analyzes nature and is ascribed to Kapila; and (6) Yoga, which is primarily devoted to the technique of meditation and is ascribed to Patañjali. This is the Hindu order; the systems are described here in another order, reflecting the relationship of ideas.

Pūrva Mīmāṃsā.—This system rationalizes Vedic fundamentalism, that is, the literal meaning and application of the Vedas. It regards the Vedas as authorless and self-revealed, and therefore as authoritative. According to the Pūrva Mīmāṃsā, the world exists throughout eternity and is not subject to recurrent dissolution and re-creation. The system accepts the reality of both the soul and the material world. There are two kinds of acts. The first consists of those ordained by the Vedas. These are the Vedic sacrifices; by doing them one obtains heaven. The other consists of prohibited acts. By doing them and abstaining from ordained acts, one suffers a future life in misery.

Sāṃkhya.—This system gets its name either from the application of reason to the analysis of the soul and nature or from the 25 principles or true entities (tattva) which it numerates. The two basic contrasting entities are soul (puruṣa) and matter (prakṛiti). Souls are infinite in number and consist of pure intelligence. Each soul is independent, indivisible, unconditioned, incapable of change, immortal. It appears, however, to be bound to matter—prakṛiti, pradhāna (Sanskrit *pradhāna*), avyakta. At the beginning of an eon nature is in a state of rest or inertia. It has three qualities (guṇa), known respectively as goodness (sattva), passion (rajas), and darkness (tamas), which are in balance. But souls, because of their karma, begin to move; nature then stirs; the qualities fall out of equilibrium. From nature then evolve the other 23 principles. The first is intelligence (buddhi), also called the great principle (mahat tattva) or the great (*mahān*); from it evolves the process or organ of individuation (ahankāra; Sanskrit *ahankāra*, I-maker). The latter differentiates itself cosmically and individually. Cosmically it produces the five subtle elements (*tanmātra*) of earth, water, fire, air, and ether, from which are produced the corresponding five gross elements (*mahābhūta*). These are the objects of sense. Individually it produces the five senses (*buddhindriya*) of hearing, touch, sight, taste, and smell, which make contact with the gross elements; the mind; and the five organs of action (*karmendriya*). With only minor variations, this physiological psychology is common to Indian thought of all schools.

According to the Sāṃkhya, every individual has a subtle characteristic body (*linga-deha*) consisting of intelligence, individuation, mind, and the 10 organs of sensation and action. This is what transmigrates, being lodged in a gross body composed of the objects of sense. How soul has come to be associated with the subtle body is not made clear. Through knowledge the association may be terminated, and this separation constitutes salvation. The subtle body is dissolved, and the soul exists in isolation. To obtain knowledge the best means is to pursue the technique of yoga.

Yoga.—This system of philosophy is an extension of the Sāṃkhya. It formulates systematically the techniques of meditation known as yoga, a word which means "harnessing" or "control" and refers to the control and suppression of the activ-

ities of the mind and the sense organs so that these will not interfere with the soul in the attainment of self-realization. The Yoga system of philosophy postulates a god, Īśvara, who is really a particular soul, supremely possessed of knowledge, goodness, and power, no longer affected by karma. He helps a worshiper in the early steps on the road to salvation.

The first stage of the yoga technique is designed to cause the evolutes of intelligence (buddhi) to retract into intelligence, and this is accomplished by *kriyā yoga* (yoga of observances of physical acts) in five stages: (1) adoption of restraints (*yama*) from lying, killing, and other evils; (2) adoption of observances (*niyama*) of purity and other virtues; (3) use of posture (*asana*; Sanskrit *āsana*) suitable for meditation; (4) restraint of breath (*prāṇāyāma*); and (5) withdrawal of senses (*pratyāhāra*) from the objects of sense. Then comes the second main stage of yoga, known as superior or royal yoga (*rāja yoga*), in three phases (*saṃyama*): (1) concentration (dharana; Sanskrit *dhāraṇā*) of the intelligence on an object without wavering; (2) meditation (dhyana; Sanskrit *dhyāna*) as an uninterrupted mental state; and (3) trance (*samādhi*; Sanskrit *samādhi*), in which the individual is fully identified with the object of meditation.

See also YOGA.

Vaiśeṣika and Nyāya.—These were separate in origin but came to be combined in a common system. Both accept the idea taught by the Vaiśeṣika that the universe arises from atoms (*anu*; *paramānu*; *kaṇa*), and use a body of logic codified in the Nyāya. The Vaiśeṣika discusses the world under six categories (*padārtha*): (1) substance (*dravya*), (2) quality (guṇa), (3) movement or action (*karmaṇ*), (4) association (*sāmānya*), (5) difference (*viśeṣa*), and (6) inherence (*samavāya*). Later teachers add (7) nonexistence (*abhāva*). The idea of difference, that is, that differences in the universe arise ultimately from differences in the atoms, gives the system its name.

The Nyāya (method, rule) gives the rules of correct thinking. There are four ways of acquiring knowledge: (1) perception by the senses (*pratyakṣa*), (2) inference (*anumāna*), (3) analogy (*upamāna*), and (4) authority or credible testimony (*śabda*). Of these inference is the most important for acquiring philosophical knowledge. The Nyāya syllogism has five parts: (1) proposition, (2) cause, (3) illustration, (4) recapitulation of the cause or application, and (5) conclusion. The standard example is of the mountain and the fire: (1) the mountain is on fire; (2) because it is smoking; (3) wherever there is smoke there is fire; (4) the mountain is smoking; (5) therefore it is on fire. Causation is considered to be material or inhering cause, which is invariable and primary for any given object; and effective cause, which is variable and secondary. Between these two there is sometimes considered to be a noninhering or formal cause. In a carpet the threads are the material or inhering cause, the association of threads is the noninhering or formal cause, and the weaver's activities are the effective cause.

In its older form the Nyāya system appears to have acknowledged the force of karma and rebirth, but not to have recognized God. Both matter and soul were regarded as uncreated and eternal. The later Nyāya, as blended with the Vaiśeṣika, recognized a god who was an indi-

vidual soul, but unlike other souls was omniscient and omnipotent and not subject to transmigration.

Uttara Mīmāṃsā or Vedānta.—More than any other, this system is the lineal descendant of the philosophic speculations of the late Rig Veda and the Upanishads. Its basic textbook, by Bāda-rāyaṇa, composed possibly around the beginning of the Christian era, is called *Brahmasūtra*, (treatise on Brahma), *Vedāntasūtra*, *Uttaramīmāṃsāsūtra*, or *Sārirakāsūtra*, and consists of aphorisms in themselves unintelligible and meant to be accompanied by a commentary.

The celebrated Shankara (Śaṅkara), whose dates are uncertain but who was living around 800 A.D., is the author of the earliest surviving commentary on the *Brahmasūtra*. He taught unqualified monism (*advaitavāda*, doctrine of the non-second). His thinking starts with an examination of knowledge (*vidyā*; Sanskrit *vidyā*). This is of two sorts: one is absolute (*nirguṇa*, without qualification) or superior (*parā*), metaphysical, and gained only by the rarest of human beings. The other is relative, has qualifications (*saṁguṇa*), is inferior (*aparā*), illusory, suitable for the general run of people, who need concrete symbols. Shankara approaches the teaching of the Vedas in the light of higher knowledge. He refers to the passages of the Upanishads in which it is stated that Brahma (neuter), the supreme reality, is one only, without a second. This, other passages state, is identical with the individual reality. It cannot be described; all it is possible to say of it is that it is "not this, not this," that is, that it is nothing comprehensible to the senses and the mind. It can be known only by itself, that is, by the soul in the individual, which is the universal soul. This knowledge is the higher, unqualified knowledge, coming from experience (*anubhava*), where subject and object become one, leading the individual to the realization "I am Brahma" (*aham brahmāsmi*). The world as we know it phenomenally is qualified being, the absolute Brahma viewed by qualified knowledge or ignorance (*avidyā*, nonknowledge), where maya (Sanskrit *māyā*, illusion or artificial construction) operates. This is Shankara's treatment of nature (*prakṛiti*). Brahma is existence (*sat*), consciousness (*chit*; Sanskrit *cit*), bliss (*ānanda*; Sanskrit *ānanda*), completely self-sufficient. The universe is created from Brahma, yet is not Brahma; maya is unreal in contrast to the absolute reality of Brahma, but relatively real as a manifestation of the real Brahma.

Maya acts as an adjunct (*upādhi*) to Brahma to produce separate manifestations of soul and matter on separate levels of devotion. It produces a personal god called Brahmā (masculine), cosmic subtle elements, cosmic gross elements, cosmic subtle body, cosmic gross body, and the individual soul, with individual subtle elements, individual gross elements, individual subtle body, and individual gross body. The transmigrating soul is enveloped in five sheaths, which are associated with the grades of devotion. In progressing from the lowest to the highest stage, the individual soul passes back through the states of waking, dreaming sleep, and deep (dreamless) sleep, to the fourth state (*turiya*), which is capable of no description and constitutes realization of Brahma.

Men who live according to relative, qualified knowledge may, after death, go to the world of the fathers, or the world of the gods, or hell. But those who devote themselves to the higher,

unqualified knowledge aim to carry knowledge up from stage to stage until it is complete and through experience one knows that he is Brahma (neuter). To this end the accepted method is by yoga, with worship of God (the masculine Brahmā) in the first stages, but beyond that with progress dependent solely upon one's own efforts.

The most prominent of other Vedānta schools is that of Rāmānuja (fl. probably 12th century, in Kanchipuram) for whom God is personal, is identified with Vishnu, and has internal differences. Souls and matter both are real. The goal of man is union of his individual soul with God. The way to release is by devotion (*bhakti*) to Vishnu. Rāmānuja's system is characterized as qualified monism (*viśiṣṭādvaita*). Another school originating in south India is that of Madhva (probably 1197-1276), who was a dualist, recognizing the reality of God, souls, and matter. No two souls are alike. Still another school is that of Vallabha (1475?-1531), who called his view purified monism (*suddhādvaita*) and rejected the idea of maya. The way to salvation is union of the human soul with the highest God (Brahmā), who is personal as Krishna and is to be reached by devotion. Another important cult centering on Krishna was that of Chaitanya (1485-1533), in Bengal. Still another sect calling itself Vedānta is that of Nīlakaṇṭha (fl. 14th century), who identified God with Shiva. Nīlakaṇṭha considered his system monistic (*advaita*). The human soul is distinct from God, but its goal is to reach God, whereupon it diminishes, atom by atom, finally uniting with Him.

See also VEDĀNTA.

Medieval Cults.—Various sects, accentuating different religious motifs mentioned above, have developed in India since the time of the Purāṇas and have been cultivated in all parts of the subcontinent. Many center around Shiva or around Shaktism; others are devoted to Vishnu, especially in the form of Krishna. The Bhakti cults have been especially common since the 14th century. Such sects have generally tended to relax caste strictures among their adherents. Other sects have shown distinct Muslim influence. Of these one of the most important is that of Kabir (1440-1518), who came into contact with Sufism.

Reformed Hinduism.—In the 19th century religious reform movements arose partly from the impact of Western ideas upon Hinduism. Among the most prominent of these is the Brahmo (Brāhma) Samāj, a theistic, nonidolatrous movement using a congregational form of worship and favoring social reform, which was founded by Rām Mohun Rāi (Rām Mohan Roy, 1772/1774-1833). Later this movement was split; one part was led by Debendranath Tagore (1817-1905), father of the poet Rabindranath Tagore; the other, by Keshab Chandra Sen (1838-1884). Several other Samājas grew up after the example of the Brahmo Samāj.

Another important movement was the Ārya Samāj, founded by a Brahman named Dayānand Sarasvatī (1824-1883), who aimed to restore the religion and social institutions of the Vedas (which he understood in his own peculiar fashion), to protect cows, to restore India's glorious past, and so to check the advance of Islam and Christianity.

Still another was founded by Rāmakrishna Paramahansa (born Gadādhara Chatterji or Chāṭṭopādhyāya, 1834-1886), a Bengali Brahman

who taught that all religions lead to the same God and frequently experienced trance. His favorite disciple, Vivekānanda (born Narendranath Dutt, 1863–1902), spread the teachings of Ramakrishna in the West, first at the Parliament of Religions in Chicago in 1893, and later in Europe. The Ramakrishna Society is active in social reform in India and in preaching in several Western countries.

See also BRAHMO SAMAJ or BRAHMA SAMAJ; MISSIONARY MOVEMENTS—*Hindu Missions*.

Buddhism.—This religion is a heterodox Indian faith in that it does not recognize the authority of the Vedic scriptures. Its founder was Siddhārtha Gautama, commonly known by the honorific title of Buddha (the enlightened one), son of a petty ruler of a clan called Śākya (Śākya) at Kapilavastu in the northeastern part of the present Uttar Pradesh. Buddhist tradition places his death in 544 B.C., but modern scholarship sets his dates as 563–483 B.C. (alternatively, 558–478 B.C.). The Vedic religion was then dominated by a highly developed ritualism under the control of the hereditary Brahman priesthood, but the Buddha is constantly represented as saying that a man is a Brahman not by reason of birth in some family but because he has cultivated the intellectual and spiritual qualities of true religion.

The young prince Siddhārtha, after living for 29 years in his native city, left home to follow the religious quest. For 6 years he “wandered” from teacher to teacher and engaged in ascetic practices, all to no avail, but at last, while seated in meditation under a pipal tree near the Ganges at Gaya in the region then called Magadha, he attained enlightenment. After formulating his doctrine, he spent the rest of his life preaching it in nearby regions. Tradition says he preached his first sermon in a deer park at modern Sarnath, just outside Varanasi (Banaras). He founded an order of monks (vowed to avoid unchastity, theft, taking of life, and falsehood) and later admitted an order of nuns, and recognized a lay congregation. He died at the age of 80.

The Buddha's teachings, as preserved in the two main bodies of Buddhist scripture, are all considerably later than the Buddha and claim to represent the deliberations of various councils called to fix the scriptures. Especially important were one (the third) held in the 3d century B.C. under the patronage of the celebrated King Asoka and another under the patronage of King Kanishka, in the 1st or 2d century A.D., when the split between the Hinayāna (Lesser Vehicle) and Mahāyāna (Greater Vehicle) was recognized. The books were long transmitted orally. The Hinayāna canon, composed in Pali, is the older and is preserved in Ceylon (whence it went to Burma, Thailand, and Cambodia), where it was first put into written form in the 1st century A.D. (possibly 1st century B.C.). It is known as the *Tripiṭaka* (Sanskrit *Tripiṭaka*, Three Baskets) and is in three parts: (1) *Vinaya Piṭaka*, rules for monks; (2) *Sutta Piṭaka*, collection of discourses (*sutta*), that is, texts of psalms, stories, and other edifying material, in five sections; and (3) *Abhidhamma Piṭaka*, collection of works of the higher religion, bearing upon psychological questions. There is also a large body of uncanonical but highly valued texts and commentaries. The Mahāyāna division first used a Prakrit for its texts; later it used Sanskrit and had a canon in Sanskrit, also called the *Tripiṭaka*, of which

many works are preserved in India and Nepal but others exist only in Chinese versions.

In the Pali canon the Buddha's basic doctrine is considered to be expressed in his first sermon, called *Dhamma-cakka-ppavattana-sutta* (*Discourse on the Turning of the Wheel of the Law*). In this the Buddha accepts, without offering proof, the familiar Indian doctrine of the cycle of rebirth (*samsara*) and karma (retribution in future existences for one's deeds), the whole constituting a process that is painful. His message is that escape from this situation comes by avoiding the extremes of sensual indulgence and physical self-mortification and adopting the middle path. His basic theory is enunciated in the Four Noble Truths: (1) birth, old age, sickness, death, separation from what one wants, association with what one does not want—all are painful; (2) the pain rises from the thirst or desire for gratification of the passions and for existence or for termination of existence; (3) the cessation of pain comes from complete extinction of this desire; and (4) the way to extinguish the desire is to follow the Noble Eightfold Path of right views, right resolve, right speech, right action, right living, right effort, right mindfulness, right concentration. In various other discourses the Buddha is represented as refusing to discuss controversial metaphysical problems concerning the duration of the world, the identity of the self and the body, and the existence of the saint after death. He gives as the psychological basis of his doctrine a chain of causation or dependent origination (*Pali paṭiccasamuppāda*) of 12 members, which starts with ignorance and ends with suffering.

The Buddha placed a low value on the things of the world but did not deny their reality. Everything about the human being is a compound of the aggregates of being (*Pali khandha*), always in a state of change and therefore impermanent and painful. The only bliss is that of the immutable absolute, which the Buddha describes as the state of nirvana (*Pali nibbāna*, blowing out). The Buddha seems to have been vague on the subject of soul; the Pali texts in their received form specifically preach that there is no soul. The Buddha's law (*dhamma*; Sanskrit *dharma*) is all inclusive, governing nature, the individual, and metaphysics. It comes in time to be the object of worship. The Buddha himself is represented as saying that he finds no one to be his spiritual preceptor but the law, which resides in him. The Pali scriptures recognize four stages in the religious life; in the final stage one attains release from rebirth and suffering. The scriptures advocate meditation (*jhāna*; Sanskrit *dhyaṇa*) with the use of methods and stages more or less similar to those of yoga. Ethics is centered on ahimsa and *metta* (loving kindness).

The Hinayāna, as taught in the Theravāda school of the Pali canon, seems to have been dominant in India until about the beginning of the Christian era. After that the Mahāyāna school grew to prominence. The principal Mahāyāna doctrines, as distinguished from those of the Hinayāna, are (1) the doctrine of the Bodhisattvas (beings whose essence is true knowledge), who have attained the ability to become Buddhas but elect to remain in the universe so that they may make over their acquired merit to other beings; (2) the doctrine of the Buddhas, innumerable supernatural beings distributed throughout time and space; (3) the worship of images; and

(4) idealistic metaphysics. This form of Buddhism spread to central Asia, China, Tibet, Korea, Japan, and Java. The principal Indian Mahāyāna schools are (1) the Madhyamaka (Mādhyamika) school, prominent from about the 1st to the 5th century A.D., whose best-known teachers were Āśvaghoṣa (c. 100 A.D.) and Nāgārjuna (fl. 2d century A.D.); and (2) the Yogācāra (Vijñāna-vāda) school, prominent from about 500 to 1000 A.D., which was promulgated by the brothers Asaṅga and Vasubandhu, who lived in the 5th century.

See also BUDDHA AND BUDDHISM; JATAKA; MAHAYANA; MISSIONARY MOVEMENTS—*Buddhist Missions*.

Jainism.—Like Buddhism, Jainism is a heterodox movement, whose historical records start in Magadha in the 6th to 5th century B.C. It was promulgated then by Vardhamāna Mahāvira, the son of a petty ruler. The Jains put the date of his death at 527 B.C., but modern scholarship sets it at 468 B.C. (or 487 or 477 B.C.). Mahāvira left home at the age of 30 to follow the religious life, and in the thirteenth year of vigorous ascetism won supreme knowledge. From then until his death 30 years later he preached in and near Magadha. Though Mahāvira was the effective promoter of Jainism and established his own order, he seems to have been preceded 250 years earlier by a teacher called Pārshva (Pārśva) or Pārshvanātha (Pārśvanātha), who had established an order that required four vows of its followers: not to injure life, to be truthful, not to steal, to possess no property. The Jain texts tell of the union of this order with Mahāvira's during Mahāvira's lifetime. Mahāvira added a fifth vow for his monks, which was that of chastity. Pārshva had allowed his followers two garments, but Mahāvira, with a strict application of the prohibition against possessing property, permitted his monks none at all. Jain tradition indicates that the question of clothing for monks remained unsolved, and at about 300 B.C. the community split on the issue into two divisions: the Shvetāmbara or Svetāmbara (white clothed) and the Digambara (sky clothed, that is, naked). The division was formally recognized in 79 (or 82) A.D.

All Jains believe that Pārshva and Mahāvira were not the founders of the faith, but only the 23d and 24th in a series of teachers all of whom are called *tīrthāṅkara*, meaning "fordmaker" (across the ocean of existence) and "founder of a church," or Jina; modern scholarship considers the first 22 to be entirely mythical. The term "Jina" is an epithet like Buddha, and means "conqueror" (of the woes of life). From it is derived the religion's own term, "Jaina," a Sanskrit word meaning "follower [or doctrine] of the Jinas."

The Jain canon, which was written in the Ardhamagadhi language and transmitted by word of mouth, is said by the Digambaras to have been completely lost early in the 3d century B.C., at the time of a 12-year famine; the Shvetāmbaras claim that part of it was preserved. The oral tradition is said to have been put into writing in 454 A.D. The Digambaras live mostly in Mysore; the Shvetāmbaras, chiefly in Gujarat.

Jainism accepts the common Indian notions of rebirth and karma, with salvation consisting of escape from the round of existence (samsara). The universe experiences a continuous cycle of decline and improvement, descending and ascend-

ing like the hand moving around the face of a clock. We are now very near the bottom in the present cycle. The Jains acknowledge no universal God, though they have many lesser divinities who are bound in the round of rebirth. The world is eternal and consists of six substances: souls (jīva; Sanskrit *jīva*), right (dharma), wrong (adharma), space, time, and particles of matter. Souls are innumerable and are of two sorts: the perfected (siddha), who live in Īśatprāghbhāra at the summit of the universe, enjoying perfect happiness, incorporeal, invisible; and those bound by a subtle body of deeds (karma) to the present world, sullied by contact with nonsentient matter. Jainism carries the doctrine of ahimsa to an extreme not otherwise paralleled in Indian religions.

Souls in the round of rebirth are by Jains considered to be of various sorts, depending upon the number of senses and certain other qualities which they possess. First there are beings called *nigoda* with none of the senses; then (1) beings with one sense, which is touch, and with body, respiration, and an allotted span of life; these include stones, clods, minerals, water bodies, fire bodies, and vegetables growing in the ground, such as potatoes, carrots, and beets, which the strictest Jains will not eat; (2) beings with two senses (touch, taste) and having, in addition to the qualities possessed by one-sensed beings, the power of speech; these include worms; most Jains start the practice of ahimsa with this group; (3) beings with three senses (touch, taste, smell), which include ants, bugs, and moths; (4) beings with four senses (touch, taste, smell, sight), which include wasps, scorpions, and mosquitoes; and (5) beings with all five senses, which include hell dwellers, higher animals, human beings, and dwellers in the various heavens—some of this class have the quality of mind. Souls suffer bondage (*bandha*) to matter (*aḥjiva*) by karma, which is good (*puṇya*), that is, valuable in accomplishing the early stages of the advance toward salvation; or evil (*papā*), retarding the progress of souls. When karma is finally destroyed, the soul, free at last, attains salvation (moksha).

The Jain community consists mostly of merchants. In theory the Jains are opposed to caste, but in practice they maintain close relations with Vaishnava merchant castes and intermarry with them.

See also JAINISM.

Sikhism.—Sikhism is a reformed sect, founded in the Punjab in the 15th century, which has drawn heavily upon the beliefs and practices of Islam. Its founder, Guru Nānak (1469–?1539), was familiar with Sufi mystic Islamic teachings; he preached monotheism, service to others, humility, self-restraint, and the mystical value of prayer. He abhorred idolatry, denied the validity of the Hindu caste system, setting up a common kitchen where all castes partook of the same food, and also opposed Muslim deistic theology. Nānak chose for God the designation Sat Nām (true name). He accepted the doctrines of karma and rebirth, of maya as a delusive force, and of guruship, that is, the magnification of the spiritual preceptor by the disciples (*sikha*, whence the name of the faith).

Guru Nānak was followed by nine other gurus. The new faith remained primarily a quietistic sect under the first five gurus, and acquired wealth. The fifth guru, Arjan (Arjun, guru 1581–1606) built (or rebuilt) a temple at Amritsar, which was demolished in 1761 by Ahmad Shah Durrani and

was restored by the Sikh ruler Ranjit Singh (1780–1839). This is the famous Golden Temple, and Amritsar is still the center of Sikh religious and political life. Arjan's successor, Har Gobind (guru 1606–1645), rejected wealth and ease and returned to the old simplicity, but adopted militarism and armed the community to resist both Muslim aggression and Hindu intolerance. The tenth and last guru, named Govind Singh (guru 1675–1708), in 1699 organized the military brotherhood into a band called the Khālsā, whose members went through an initiation ceremony, took names ending in Singh (lion), abjured wine, the narcotic hemp, and tobacco, forbade the cutting of the hair (*keś*), and imposed the carrying of a dagger (*kirpan*) and the wearing of drawers (*kach*), an iron bangle (*kartha*), and an iron comb (*kanga*). He was murdered in 1708. From the time of Har Gobind the Sikhs were in frequent conflict with the reigning Muslims. In the 19th century, Ranjit Singh established a Sikh kingdom in the Punjab, and Sikh political power extended from the Sutlej River into Afghanistan. After the Sikh Wars a final treaty was consummated with the British in 1849.

The Sikh scriptures consist of a book called Granth Sahib (Revered Book), which contains a great deal of prose and poetic material ascribed by Sikhs variously to Nānak, Kabir, and other teachers. It is regarded as the sole repository of religious authority and is held in veneration by all sects of Sikhism.

See also SIKHS.

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ISLAM

Islam in India has in one sense been in principle the same as Islam anywhere else, and in another sense it has necessarily acquired or produced special qualities relating to the unique Indian environment of those whose personal faith it has been. The dialectic between these two truths has constituted the character of Indian Islam. The endeavor here is to sketch the development of the peculiarly Indian understanding or expression by Muslims of their faith. It must be remembered throughout, however, that Muslims in India, confronted by the highly particular situations and problems that they met there from day to day and century to century, have had constantly available to them ideas, institutions, and personnel, including many of their leaders, from outside India in the wider Muslim world, as well as a cherished and graphic memory of the normative pre-Indian phase of their (Islamic) history.

Apart from the content of this ever-fresh supply of inspiration, its form too has been important. The sheer fact has often been consequential that the Muslim has lived in India dimly or vividly aware that he belongs, or belongs also, to a wider world transcending India in space and time and in his loyalty. All religious men have recognized that the immediate and tangible environment is subordinate to a higher reality; and India has honored this recognition and encouraged it. In the case of the Indo-Muslim, however, there has been a more complex, three-fold involvement: through Islam he has been related not only to the immediate environment and to God, but also to a partly alien tradition.

This states the problem from an Indian point

of view. Making the same point Islamically, one may observe that the environment in which the religion has had to relate its adherents to God has been a peculiarly complex and recalcitrant one. Most saliently, India has been the only major part of the Islamic world in which the community has continued to be a minority; only here has the religion proved of large-scale, sustained, sociocultural creativity where its adherents' task has been to live out their lives Islamically in a society of which most members have had other visions.

Elements of Indian Islam.—Two distinct and at times even opposed elements may be observed in the successful response of Islam to the situation described above. Neither is peculiar to or original with the community in India, yet both have developed there in special ways. They are power and Sufism (formal mysticism). The former is an aspect primarily of the political history of India. Suffice it here to touch upon the religious implications of the massive effectiveness of the Ghaznavid, Ghurid, Bahmani, and other dynasties in establishing Islamic rule in increasing parts of the subcontinent, culminating in the splendor and widespread might of the Mughuls (Moguls). The Qutb Minār in Delhi, symbol of conquest and power, may be seen as representing both the affirmative energy of the faithful in building up their dominion and the psychological comfort of feeling it secure. When six centuries later this power began to crumble, and in 1857 collapsed, repercussions in religious as in other aspects of the society's life were grave. In 1947, with outside rule withdrawing, the Pakistan movement may be interpreted in part as an assertion by many Muslims that Islamic life in the particular environment of India cannot be postulated without power.

The Sufi element in Indian Islam is at least equally important, more intimate, and perhaps more lasting. The faith was spread in India primarily by Sufis, and sustained primarily by them. The personal lives of individual Muslims have been Islamic largely in and through the structure and teaching of Sufi orders. In no major section of the Muslim world has Islam been Sufi oriented more than in India, and perhaps in none even equally so.

Of the many thousands of Sufi saints and leaders whose lives and interpretations at different times and in many places have expounded the faith and converted men to it or kept them responsive, many are nameless, and of course even of the others most must be so in so brief a survey as this. We may mention, however, a few of the exceptionally outstanding. In the early medieval period the two most usually noted are Mu'in-ud-Din Chishtī (1142–1236), who came from central Asia in 1192 and brought the Chishtī order, which he established in India; and Nizām-ud-Din Awliyā' (1238–1325). Their legends have inspired many millions of believers, and the celebration of their 'urs (festivals) at their tombs in Ajmer and Delhi, respectively, is still an occasion for pilgrimage for scores of thousands annually. Of the missionary Sufis in addition to Mu'in-ud-Din, south India traces its conversion primarily to such saints as Sayyid Nathar Shāh (969–1039); Muslim Bengal, to Makhdūm Jalāl-ud-Din Tabrizī (d. about 1244), followed by many others, including Mawlānā 'Aṭā' Muhaqqiq (d. about 1355). While the elite nourished their Sufism on Persian literature, in which the poetry



Above: The white marble Taj Mahal (begun in 1632) at Agra. It was built at the apogee of Mogul power in India by Shah Jahan as a tomb for his favorite wife, Mumtaz Mahal, and is considered by many to be the most beautiful building in the world.

INDIA

Right: The Birla Temple and reflecting pool, New Delhi.

(Top) Herbert Mendelsohn, (center) Victor F. Kayfetz, (bottom, left and right) Cutler J. Coulson, from Shostal

Bottom left: Women carrying water from a well near Aurangabad in Hyderabad, southern India. Bottom right: a wedding procession at Delhi.





Above: Cattle and camel fair in Rajasthan State. Camels are important since much of Rajasthan is desert.

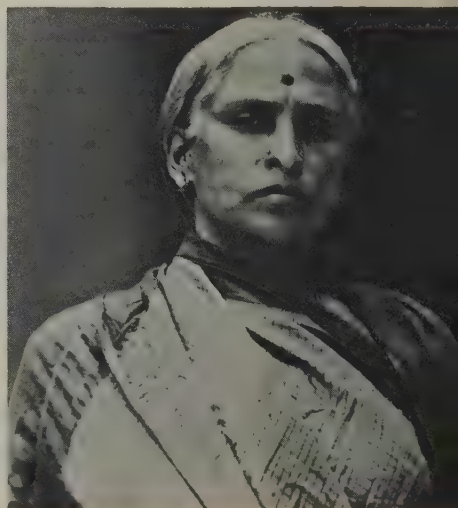
INDIA

(Top) Marc Riboud from Magnum; (center right) Kulwant Roy; (right and below) Musée de l'Homme; (bottom left) The Ford Foundation



Below: Meeting of the panchayat (council) of a Rajasthan village. Vital improvement projects are promoted by workers (wearing pullovers here), trained for India's massive Community Development Program.

Above left: In a test of his physical control, a disciple of yoga supports a steam-roller on his chest. Above right: A young Assamese girl from the Naga Hills area. Below right: A high-caste Brahman matron of southern India.



of Jalāl-ud-Dīn Rūmī (1207–1273) took pride of place, the common people found theirs sustained in the vernacular. The devotional life of the lower classes of the Punjab, for instance, has for long been expressed and fed by the poetry of such Sufis as Bullhe Shāh (c. 1680–c. 1758) and Wāris Shāh (fl. late 18th century), whose influence has been great with Hindus and Sikhs as well as Muslims; of Sind, by that of such Sufis as Shāh ‘Abd-ul-Laṭīf (c. 1689–c. 1752); of Bengal, by that of Sayyid Sulṭān (c. 1550–c. 1648), Sayyid al-Awwal (1607–1680), and others. Of the many Sufi orders represented in India, the most widespread and influential have been the Chishtīyah (from the 15th century), the Naqshbandīyah (from the 17th century), and, to a lesser extent, the Qādirīyah (from the 15th century) and in earlier times the Suhrawardīyah (13th century).

Concerning the content of Sufi thought and practice, Indian Islam had available to it virtually the whole diverse range of this aspect of the Islamic tradition, from orthodox to extremist, and had available also to a degree not yet carefully measured the influence of the somewhat similar Vedānta tradition of the surrounding Hindus. The first systematizer of Sufi thought in Islam, Hujwiri, came from central Asia to Lahore and died there (shortly before 1100). Of significant original thinkers in Islam, one may mention ‘Abd-ul-Quddūs Gangohī (d. about 1543) and, chiefly, Shaykh Ahmad Sirhindī (c. 1546–1624), who formulated a careful and eventually highly effective rejection of the pantheistic version of Sufism, insisting instead on an interpretation by which it could be, as it then increasingly was, subsumed under an Islam strictly within the bounds of the classical norms.

These norms, and especially the religious law (*sharī‘ah*), were brought with Islam’s advent into India, but only gradually and relatively late did they come to prevail and dominate. They were guarded and championed by the orthodox scholars, such as the influential ‘Abd al-Ḥaqq Muḥaddith of Delhi (1551–1642), and were institutionalized in the madrasah schools, of which one may mention chiefly Firangi Mahall, Lucknow, founded in 1693. Indian scholars cultivated and adorned these studies, though they did not basically develop them. A great compilation of law, the *Fatāwā-i ‘Alamgīrī*, is to be remarked under the Mughuls (17th century). Also worthy of note is the *Dars-i-Nizāmī*, a curriculum set up in the 18th century and still in force, for the formation of scholars, with a basis in *tafsīr* (commentary), *ḥadīth* (tradition), *kalām* (theology), and *fiqh* (law) from the classical Arabs but not without a certain flavoring of Sufi elements as well.

Relations with the Hindu Faith.—Islam’s first entry into India, on the west coast from Sind to Malabar (7th and 8th centuries), was of limited consequence compared with its later violent arrival (begun in 1001) through the Khyber Pass with the armies of Mahmud of Ghazni and his successors. This, with its vehement iconoclasm and exclusivism, was an overpowering onslaught on the religion of the Hindus such as India had never seen and has not yet quite forgotten or forgiven. The Sufis’ presentation of Islam, on the other hand, which presently gathered strength, won much of India’s heart and indeed in later centuries formally converted to the new community many millions of its inhabitants, chiefly no

doubt from the lowest castes. Although there is considerable room for investigation as to how far Islam and particularly Islamic Sufism of extra-Indian origin influenced the rise and spread of the Hindu Bhakti movement (11th to 16th centuries) and vice versa, in any case the fact is that relations between the two communities not only improved vastly but even reached a stage where syncretism seemed a possibility. This culminated under the Mughuls in the 16th and 17th centuries: politically in the reign of Emperor Akbar (1556–1605); culturally in such creations as the Taj Mahal (Tāj Maḥall, 1632–1653), miniature painting, and music; ideologically in Dārā Shikōh (1615–1659). The Urdu language might also be instanced. Some Muslims viewed the process as threatening the utter absorption of Islam within Hinduism and its eventual death. A reaction set in, expressed politically in Aurangzeb (r. 1658–1707) and intellectually in the movement stemming from Sirhindī. Politically, the reaction was either too late and too feeble, or else too vigorous and rigid—depending on one’s point of view; in any case, it was followed by failure, the disintegration of Mughul and presently all Muslim political and other power, and in the late 18th and early 19th centuries by social and intellectual demoralization and decline. Significant new Islamic developments since 1707 have been attempts to wrestle with that demoralization and decline, to rehabilitate the Muslim community in India both temporally and spiritually.

The foundation thinker for the new phase was Shāh Waliyullāh (1703–1762) of Delhi. His work was essentially purificationist and revivalist, aiming ideally at a restoration of a refurbished Sufism and a refurbished orthodoxy, in synthesis, and at a refurbished political power. This religious development was only beginning to work itself out, however, when it was enormously complicated by the new intrusion of the West. Although their ideological inspiration lived on, early 19th century uprisings (called Mujāhidin, or by their opponents Wahhābī), vigorously attempting to reinstate Muslim dominion and to erect a purified, truly Islamic society, were crushed. Indian power, whether Muslim, Hindu, or Sikh, was replaced for a time by British—not only politically but economically and culturally. In the second half of the 19th century and the early 20th century the community addressed itself chiefly to the new and perplexing relationship to the West. The gracious but potent leader here was the many-talented Sir Sayyid Ahmad Khān (1817–1898), and the phase is initially represented by the college that he founded in 1875, now Aligarh Muslim University. It was designed to make available to the Muslim community a modern (Western) education along with an Islamic training. The former produced an effective elite, but no synthesis was forthcoming. In the 20th century the brilliant and highly influential philosopher-poet Muḥammad Iqbāl (1876–1938) perhaps came closest to this with a scintillating eloquence affirming some reinvigorated elements from the Sufis along with some from modernity. Though his exuberance did not include a clear program, yet his work apparently reaffirmed the substance of the classical norms and actually heralded the next development, a reversion. For as had been the case in earlier centuries vis-à-vis the Hindus, but much more rapidly, overt conflict with the West gave way to rapprochement moves and then these to withdrawal.

When for various reasons Pakistan was proposed about 1940, most of those who responded religiously did so envisaging it as a solution to the problem of relationship to Hindus and as a revitalized reassertion of the community's normative tradition. The one vigorous religious formulation, that of Abū-l-A'lá Mawdūdī (1903–), is continuous with orthodoxy, likes power, and repudiates Sufism, Hinduism, and the West. Pakistan has found, however, that what was once the West has become international modernity. Islam must apparently live with and even through it or be downed.

The faith of the large section of the Muslim community living since 1947 in India has to cope with this problem and also with those of powerlessness and what is now more urgent than ever, the relationship with Hindus. In both Pakistan and postpartition India, Islam continues to face some of its deepest and most challenging problems.

See also 7. *Architecture and Art—Art Following the Muslim Impact: 13th to 20th Century*; 11. *Literature—Modern Indo-Aryan Literature*; 14. *Law—Islamic Law*; 17. *History: 6th Century B.C.–1707*; 18. *History: 1707–1947*; and separate articles on ISLAM; MISSIONARY MOVEMENTS—*Muslim Missions (India)*; MOSLEM SECTS; PAKISTAN; SUFISM.

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CHRISTIANITY

The three major traditions of the Christian Church—the Eastern, the Roman Catholic, and the Protestant—are all present in India. The most ancient of these is the Eastern tradition. It now comprises four major groups known collectively as the Christians of St. Thomas, for they share the conviction that the church was established on the Malabar Coast through the missionary efforts of the Apostle Thomas. Near Madras is a hill where the saint is said to have been martyred. The early days of the St. Thomas Church are obscured in legend and find questionable support in the infirm geographical references of such works as the *Acts of St. Thomas*, which was probably written first in Syriac and later was translated into the Eastern tongues and into Latin. It can be stated with accuracy only that it is not impossible that the church was founded very early (even as early as its claims would indicate), and that its establishment and nurture were the work of immigrants to India from the eastern Syrian and Persian churches often termed Nestorian or, perhaps, of Catholics of the Chaldean Rite. The traditions and government of the church seem always to have been "foreign," and it is supposed that little concession was made to the Indian scene in thought or social practice, except that the members were accepted by surrounding Hindus as a group apart, which took its place rather high in the social structure of Hindu caste.

The Portuguese who came to Malabar early in the 16th century were welcomed by the St. Thomas Church. Gradually increasing control was exercised by Portuguese evangelists until, in the first half of the 17th century, a loose unity was made firm under Roman obedience. Those Malabar Christians of the Syrian Rite who have continued under Rome are known as Romo-Syrians. In 1653, however, about half of the St. Thomas Christians, feeling that their independence was in jeopardy, broke with Rome. Known as Jacobites

after Jacob Baradaeus, a 6th century Monophysite bishop, they have had a history marked by personal struggles for power. The continuing Jacobites are divided into two groups: those who recognize a patriarch; and the orthodox, who are ruled by a catholikos. The fourth major group of the St. Thomas Christians consists of the Mar Thoma Syrian Church, which seceded from the main body of the Jacobites in the mid-19th century. Evangelical in nature, this church forms an integral part of the cooperative Protestant movement and is in communion with the Church of South India. It sends colonizing groups as units to other parts of India, where they live a life in touch with the larger community.

Roman Catholicism.—From the beginning the Portuguese linked their quest for trade and colonies with evangelization, and the period of Roman Catholic missionary enterprise in India therefore opens with the arrival of Vasco da Gama at Calicut in 1498. Goa, which became the capital of the Portuguese territories in 1530, has remained the center of Roman Catholic activity in India. Because of its intimate links with secular colonial power, the church in Goa has been regarded as a European creation alien to the soil of India.

Among the first Roman Catholic priests who arrived in India early in the 16th century were Franciscans and Dominicans, of whom some were charged with the spiritual care of the Portuguese themselves and others were commissioned to act as missionaries. Then, in May 1542, less than two years after the establishment of the Society of Jesus, there arrived in Goa the first of two significant Jesuits. This was Francis Xavier (1506–1552), probably the greatest missionary that Europe has contributed to Asia. He was a scholar, a mystic, and a saint in both the Western and the Indian interpretations of the word. Despite little or no proficiency in any Indian tongue, he identified himself with the distressed masses of the people rather than with the luxury-loving Portuguese of the colony. The effects of his mission were widespread, for although he did not grasp the meaning of Indian culture, his saintliness, his obviously mystical nature, and his identification with the people won several hundred thousand converts to Christianity, largely from the depressed peoples of the western coastal areas of the peninsula. After his death in China in 1552, his body was brought to Goa, where it still remains.

While St. Francis' mission was identified with the sufferings and the life of renunciation of India, there was little appreciation of the religious philosophies which underlay Indian life, and Portuguese officialdom apparently received carte blanche to outlaw Hindu practices in the Goan area. With the study which the Jesuit Order fostered of language, religion, and literature, however, it was finally realized that here was a civilized people, inheritors of a great tradition, and that no missionary effort would succeed unless it took these things into account. Consequently, in 1606, a personality as colorful as Francis Xavier invaded the stronghold of south Indian Brahmanism, the city of Madurai. Father Roberto De Nobili (1577–1656), a brilliant linguist and a bold thinker, felt that the secret of the expansion of the church in India lay in the conversion of the Brahmans, the traditional leaders of Hindu religion. He studied Hinduism extensively and presented Christianity in a manner as little revolu-

tionary as possible. He himself took on the accouterments of the Hindu Brahman, and he sought to prove that pure Hinduism was much closer to Christianity than the prevailing popular practices. His sympathy for what he considered marginal social practices was successful in creating a church in Madurai, but much controversy was aroused because high-caste converts were permitted to continue the practices of caste, including that of untouchability. De Nobili was denounced by one of his followers as an impostor, in that he was believed to be a rishi (Sanskrit *ṛṣi*) from the West who had come to fulfill Vedic injunctions. This accusation played into the hands of those Christians who had criticized his work as indiscriminate syncretism, and he was forced to spend much time in defending himself to Rome. For over 40 years, De Nobili continued a type of mobile evangelism in the India he loved and in the Indian way of life he loved. His was a unique sympathy with the Indian people.

From Goa and from Madurai the successors of Francis Xavier and De Nobili established an extensive network of Roman Catholic mission stations. By the 1950's, the Indian church had its own cardinal as well as 19 archbishops, 51 bishops, and a large number of institutions.

Protestant Churches.—When representatives of Protestant countries of the West first reached India, they did not carry with them the same urge to Christian evangelism that was the inevitable accompaniment of Portuguese conquest. The Dutch were interested only in trade, and the English followed their commercial relations with political ambitions. In these ambitions there was no place for Christian propagandists, nor was there in the home countries themselves any real impulse to evangelization. The first instance of a sense of Christian mission from a Protestant source came from Denmark, which maintained a small trading post at Tranquebar in Madras. Here Protestant missions to India can be said to have originated. The first missionaries were the Germans Bartholomäus Ziegenbalg and Heinrich Plütschau, who reached Tranquebar in 1706. The greatest was Christian Friedrich Schwartz (1726-1798), who arrived there in 1750. His exemplary life gained him the confidence of all concerned, and he successfully negotiated diplomatic commissions between the British and their Muslim opponents in south India. With his death in 1798 the greatness of the Tranquebar mission declined.

English missionary enterprise received its first great impetus from William Carey (1761-1834), who dreamed at his cobbler's bench in England of far-off lands where he could exercise a Christian vocation. Eventually, through the Baptist Missionary Society, he was able to undertake a mission to India. Arriving in Calcutta in 1793, he was prevented by the British East India Company from establishing a mission in British-controlled territory. In 1799, however, with William Ward and Joshua Marshman, he established at the Danish settlement of Serampore a mission which emphasized education and the dissemination of literature through the printing of the Bible and other works in 36 languages.

After the East India Company lost its trading monopoly in 1813, it changed its policy regarding Christian missions. Hitherto only chaplains to the British community had been admitted. Now the London Missionary Society joined the pioneering Baptists, who were at last able to operate in British territory, and the Church of England with its

two organizations, the Society for Promoting Christian Knowledge and the Church Missionary Society. The Methodists also sent representatives to India, and the Scottish Missionary Society began its remarkable work in higher education—in Bombay under John Wilson (1829), in Calcutta under Alexander Duff (1830), and in Madras under John Anderson (1836). Americans were first represented by the American Board of Commissioners for Foreign Missions, founded in 1810 as a nondenominational body but shortly thereafter related to the Congregational Church.

Protestant Christianity in India had now entered its denominational phase, in which the various communions of the British Isles, the United States, and continental Europe sent missionaries to establish churches and humanitarian, educational, medical, and agricultural institutions. The new Christian churches not only made converts, but also influenced those who were to become India's courageous Hindu and Muslim reformers. In Bengal, Rām Mohun Rai (1772/1774-1833) created the Brahmo Samāj, a unitarian movement synthesizing the theistic elements of Hinduism with a social and ethical outlook inspired by Christianity. This and similar movements in Bombay challenged the lethargy and stagnation of contemporary Hinduism and led eventually to a period of renaissance and a new synthesis of far-reaching significance. The Muslim community began a movement of education and reconstruction extending from Sir Sayyid Ahmad Khān (1817-1898) to Muḥammad Iqbal (1876-1938).

The transition from multiple Protestant denominations came through the development of necessary cooperation and union. In 1914 the National Missionary Council was established. Renamed the National Christian Council, it is a consultative body which recognizes the integrity and sovereignty of the various denominations, but seeks through conferences and research to resolve questions of concern to all. It is in communication with the International Missionary Council and the World Council of Churches on questions involving Christianity in India and the world concerns of Indian churches. A further step was taken with the creation of such bodies as the South India United Church and the United Church of Northern India, which comprise Presbyterian, Reformed, and Congregational bodies in their respective areas. The most far-reaching movement toward unity was the inauguration of the Church of South India on Sept. 27, 1947. The result of years of consultation, this step makes possible the naturalization of the Christian Church on Indian soil.

The Indian church is concerned to find its place within the stream of Indian history without "foreignness." As a result, certain unique expressions of Christian life and thought have appeared, among them ashramas (Sanskrit *āśrama*), modeled on the traditional Hindu centers of the disciplined religious life. The unique characteristic of the Christian ashramas is that they reach out in terms of education or social service in a way which is not always present in the Hindu ashramas. They exhibit a new freshness of approach to some of the perennial problems of Indian life and thought. See also MISSIONARY MOVEMENTS—*Modern Christian Missions*; biographies of the leading missionaries.

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14. LAW

Together with Pakistan, India became an independent nation on Aug. 15, 1947, under the terms of the Indian Independence Act (10 and 11 Geo. 6, Ch. 30). Its constitution, which was adopted by a Constituent Assembly on Nov. 26, 1949, and went into effect on Jan. 26, 1950, retained the laws already in force, subject first to the fundamental rights guaranteed therein, and second to subsequent legislation by the central legislature (Parliament) and the state legislatures within their special and concurrent spheres. The Indian Constitution is based on the Government of India Act of 1935, with elements derived from the United States Constitution. It is the supreme law of the republic, although it is more easily amended than the United States Constitution (by 1959 it had been amended seven times). The highest court, the Supreme Court, exercises a wider jurisdiction than the House of Lords in Great Britain, and it is not bound by its own decisions.

General Law.—Indian courts readily rely on English and, particularly in constitutional matters, American decisions. The common law of England is in force in the original civil jurisdictions of the high courts of Bombay, Madras, and Calcutta (which represent the old supreme courts) insofar as the law is not covered by statute or by the systems of personal law reserved for Hindus and Muslims. In similar matters, which rarely arise, all other jurisdictions apply "justice, equity, and good conscience." As the case may require, this means the general principles of the personal law that are most nearly applicable; the common and statute law of England, if it is not unsuitable to Indian conditions; or the judge's sense of propriety, founded upon a developed system of law.

While Parsis have their own statutory marriage, divorce, and succession laws, and Jews have their own customary matrimonial law, Armenians come under the general law. Christians (Armenians and others) are governed by the Indian Succession Act of 1925 (or by the Travancore Christian Succession Act of 1917), by the Indian Christian Marriage Act of 1872, and by the Indian Divorce Act of 1869, all of which approximate to obsolete English statutes. Since 1772 Hindus and Muslims have been privileged to use their own systems of law in family and religious matters, but the general law has impinged increasingly upon these systems in such fields as transfers of property, income tax, estate duty, and wealth tax. The Indian Constitution promised an Indian civil code, of which the so-called Hindu Code of 1955–1956 represented the first step. Similarly, it was hoped that the Special Marriage Act (Act 43 of 1954), which repealed and re-enacted with amendments Act 3 of 1872, would induce many Indian couples to register their religious marriages and so subject themselves and their issue to the general law in matters of matrimony and inheritance. Under that act all Indians who are over 21 years of age (males) or 18 years of age (females) and are not disqualified by a subsisting marriage may be married in a civil ceremony.

In general, Indian statutes dealing with finance, commerce, industry, welfare, and defense, as well as those relating to government ownership or supervision of the sources of wealth, are modeled on English precedents. Some, however, such as the Companies Act (Act 1 of 1956), diverge substantially in parts, and nowhere is Indian law a mere importation from the West.

After the constitution the fundamental law

still stems from the Anglo-Indian codes. Enacted in groups over the years, the codes were due to successive Indian law commissions working either in India or in England. In particular, they owed much to the skill of Sir John Romilly, Thomas Babington (later 1st Baron) Macaulay, Sir Henry James Sumner Maine, Sir James Fitzjames Stephen, and Whitley Stokes. These codes, which anticipated law reform in England, diverged from English law where the latter was too technical or imperfect. Their style reflected Utilitarian influence and, in places, French and American inspiration. Among the most famous of the codes are the Indian Penal Code of 1860, the Indian Succession Act of 1865, the Indian Contract Act of 1872, the Indian Trusts Act of 1882, the Transfer of Property Act of 1882, the Code of Civil Procedure of 1908, and the Code of Criminal Procedure of 1898 (often amended).

Some of the characteristic features of Indian law are the absence of jury trials; the fact that the profession is not divided into barristers and solicitors; the prevalence of compulsory registration of property transfers; the lack of registration of marriages and adoptions; the fact that testaments do not require probate; and the use of *benami* (Hindi *benāmī*) transactions, in which the real parties are concealed behind nominees.

Hindu Law.—Applicable to 85 per cent of the population of India, the system of Hindu law falls into three categories: (1) the *Dharmaśāstra*, the ancient Indian religious and civil law; (2) Anglo-Hindu law; and (3) modern Hindu law. Prior to 1827, Hindu criminal law was in force in Bombay Presidency, and it had been applied earlier in Banaras. Hindu law was the law of the land where the rulers were Hindus, and elsewhere it influenced the administration of justice by customary tribunals and even, in some of the Mughul (Mogul) jurisdictions, by courts sanctioned by authority. With the growth of British power, it was gradually superseded by statutory rules or, in the law of contracts, torts, and trusts, by rules which seemed consistent with English principles and were not repugnant to Hindu principles.

Dharmaśāstra.—The *Dharmaśāstra* covers the laws governing social, spiritual, civil, criminal, and constitutional matters—that is, the *varṇāśrama dharma*, or the duty (*dharma*) incumbent on persons according to their caste (*varṇa*; Sanskrit *varṇa*) and stage of life (*āśrama*; Sanskrit *āśrama*). Members of the numerous castes of India were classified in theory as either Brahmins (Sanskrit *Brāhmaṇa*), Kshatriyas (Sanskrit *Kṣatriya*), Vaisyas (Vaiśyas; Sanskrit *Vaiśya*), or Sudras (Shudras; Sanskrit *Sūdra*). The main duties of the Brahmins were to learn and teach the Vedas, to perform sacrifices, and to give and receive charity, while the chief duty of the Kshatriyas was to protect the people, that of the Vaisyas to engage in trade, and that of the Sudras to work for the three higher castes. These three castes were called twice born (*dvija*), because boys of these groups underwent an initiation ceremony which entitled them to study the Vedas and was considered a second birth. There were four *āśramas*: (1) that of the Vedic student (*brahmachārīn*), observing chastity and showing deference to his preceptor (*guru*); the householder (*grhastha*), a married man maintaining his family and propitiating his deceased ancestors with *śrāddha* ceremonies; the forest recluse (*vānaprastha*); and the ascetic (*sannyāsīn*), who had entirely abandoned the world. Most Indians are house-

holders nowadays, but there are some *brahmācārīn* and a few *saṃnyāsīn*.

In ancient India the king or his deputy maintained order and administered justice with the advice of Brahmans learned in *Dharmaśāstra*. The king himself was supposed to be trained in that science as well as in *Arthaśāstra*, the science of government. Most civil and social offenses and disputes were dealt with by tribunals (now known as panchayats) of a particular locality, caste, or profession, which made their decisions on the basis of custom. The ultimate sanction of the tribunals was excommunication.

There are six main sources of the *Dharmaśāstra*: (1) the Vedas, which provide scattered examples and indications of general principles; (2) the *Dharmasūtras* (thought to have been compiled before the 4th century B.C.), which are written either in prose or in a mixture of prose and verse and are attributed to such sages as Gotama (Gautama), Āpastamba, and Baudhāyana; (3) the *Smṛtis* (also known as *Dharmaśāstras* and dating from the 2d to the 7th century A.D. in one view, though according to others some specimens date from as early as the 4th century B.C.), which are written in verse and are attributed to Manu, Bṛhaspati (Brhaspati), Yājñavalkya, Nārada, Kātyāyana, Viṣṇu (Viṣṇu), and others; (4) commentaries on *Dharmasūtras* and *Smṛtis*, such as Medhātithi's commentary on Manu (c. 800 A.D.) and Vijñāneśvara's on Yājñavalkya (the celebrated *Mitākṣarā* text; early 12th century); (5) digests of *Dharmasūtra* and *Smṛti* texts, such as Lakṣmīdhara's *Kṛtyakalpataru* (c. 1050) and Mitrāmīśra's *Vīramitrodaya* (c. 1630); and (6) original treatises based on previous sources, among them Jīmūtavāhana's *Dāyabhāga* (early 12th century), Devaṇabhāṭṭa's *Smṛticandrikā* (early 13th century), Vācaspati-mīśra's *Vyavahāracintāmaṇi* (c. 1475), Nandapaṇḍita's *Dattaka Mīmāṃsā* (c. 1620), and Nilakaṇṭha's *Vyavahāramayūkha* (c. 1635). The epics and Purāṇas served as subsidiary sources of law. These sources were interpreted by jurists in terms of local usage and the requirements of jurisprudence. A distinction was made between what was morally desirable and what was legally essential.

Beginning about 1850 successive inroads were made into the practical application of the *Dharmaśāstra*, and by 1956 it survived only in the remoter Hindu communities and in religious contexts. The authority of the caste panchayats was reduced by the prohibition of excommunication in Baroda and then in Bombay State in 1949, and by attempts to eliminate the disabilities of the outcaste untouchables in state statutes and in the central government's Untouchability (Offences) Act (Act 22 of 1955).

Anglo-Hindu Law.—Anglo-Hindu law was based upon the *Dharmaśāstra* as reported to the British authorities up to 1864 by Indian experts. Between 1772 and 1955–1956 it was applied in India in matters of marriage, minority, adoption, succession, gifts and wills, the joint family, partition, maintenance, debts, religious endowments, and impartible estates. Apart from the joint family, only marginal matters were governed by it thereafter.

The opinions of the pandits (*paṇḍita*) were collected, compared with early translated texts, and systematized by Sir William Hay Macnaghten (1828–1829) and by his contemporary, Sir Thomas Strange. Their compilations wielded great influence, as did those of their successors, particu-

larly the textbooks of John D. Mayne and Sir Dinshah F. Mulla. Many of the ancient rules, such as those on disqualification from succession, were discarded as incapable of being administered under the British system. Others, such as the unfitness of an only son for adoption, were dropped as not intended from the first to be legally enforced, while a few were rejected as being against public policy. Gradually the laws were modified and amplified through principles of equity and through the enactment of laws of Western origin. Among statutory changes, the following were the most striking: from 1850 on, loss of caste ceased to involve loss of property rights in British India; widows have had the right to remarry since 1856; many disqualifications from succession were abolished in 1928; and the capacity to marry was broadened in 1946 and 1949.

Since there were many discrepancies between the sources, the courts frequently disagreed, and several schools of Hindu law were recognized. Nevertheless, the Privy Council in London supervised the growth of Anglo-Hindu law up to 1949 to fairly general satisfaction.

A custom, even that of a family, which was ancient, invariable, and not against public policy, might, if satisfactorily established, bypass Hindu law, creating a curious patchwork effect. Thus, divorce might be permitted, females might be excluded from succession, and a sister's son might be adopted. Moreover, before 1955–1956 some Indian states had special rules of their own. Subject to these reservations, the more striking features of the system with regard to marriage, adoption, the joint family, succession, and the like are described below.

Marriage was prohibited, but not necessarily void, between males under 18 and females under 15. It was void if between sapindas (Sanskrit *sapinda*), descendants from a common ancestor within five degrees inclusive on the mother's side or within seven degrees inclusive on the father's side; until 1949, if between *sagotras*, members of the same patrilineal family or persons having the family name in common; or if between members of different major castes. Marriage was indissoluble except in Bombay (from 1947) and Madras (from 1949), and the grounds on which a marriage might be annulled were in dispute. A man might have several wives concurrently. Either party could petition for the restitution of conjugal rights, and an ill-treated or deserted wife might sue for separate maintenance. A wife was regarded as half her husband's body, and a widow who remained chaste and unmarried was entitled to maintenance from her husband's estate.

While minority ended at 18, it was possible to adopt at an age as young as 15. Even a *de facto* guardian might validly alienate his ward's property for the latter's benefit or for legal necessity. In order that the male line might not be extinct, a man who had no sons might adopt one son (at a time) at his pleasure even if he were married, provided that the boy's mother would not have been prohibited to him for marriage, and that the boy was of the same caste and uninitiated (in the case of a Sudra, unmarried). Subject to conditions varying with the school of law, a widow might adopt to her husband (but not to herself as distinct from her husband), and the adoptee would be considered a posthumous legitimate son.

The joint family is the characteristic Hindu way of life and form of property ownership. It is patrilineal, and tends to be patriarchal. Accord-

ing to the *Mitākṣarā* school, males within four generations, inclusive, form by right of birth alone a coparcenary (joint heirship) in the ancestral property and its accretions, and the death of one increases the shares of the others by the operation of survivorship. (According to the *Dāyabhāga* school, a coparcenary interest is a defined share which passes by succession and not by survivorship.) The rights of survivorship end when the estate is partitioned or severed. Females may depend on the coparcenary property for their maintenance. Since 1863 a coparcener has had the right to appropriate what he has acquired through his own efforts, which then descends to his widow or other heirs, and by the Hindu Gains of Learning Act of 1930 all earnings not made directly by the employment of joint family funds are exempt from the claims of the other coparceners. Alienations by the "manager" of the family (usually the senior active male) bind all members if they are for necessity or for the benefit of the family (speculation is excluded). In the states of Bombay, Andhra Pradesh, Madras, Mysore, and Kerala a coparcener may freely sell or mortgage his undivided interest in the family property. From 1937 to 1956, under the Hindu Women's Rights to Property Act (Act 18 of 1937), the widow of a *Mitākṣarā* coparcener succeeded to her husband's place in the coparcenary, as well as taking a share equivalent to that of a son in his separate estate.

Succession to the estate of a male decedent was mainly agnatic (through males only), with heirs succeeding in a long order of priority, the nearer generally excluding the more remote. The widow, daughter, and daughter's sons followed in that order after the male issue, these last taking as a single heir. The act of 1937, however, improved the widow's position. The illegitimate sons of Sudras were allowed to take half a legitimate son's share, and in some cases they took a half or even all of an estate. A male inherited an absolute estate, but a female (with exceptions in Bombay) inherited a limited estate. This limited estate was better than a life estate in Anglo-American law, for a female could, in case of necessity, alienate her property absolutely. Her mismanagement could, however, be checked by the reversioners. With the consent of the nearest reversioner, she could, in practice, give a good title, but without such consent and without justification she could give a title that would endure only until she forfeited the estate by remarriage, surrendered it, or died. These restrictions applied equally to heiresses of females. Succession to females was complex, and differed according to the school of law and the mode of marriage of the deceased. Hermits were succeeded by their spiritual heirs and not by their kin, from whom their renunciation severed them in law.

To the extent of their interest in a *Mitākṣarā* joint family property, sons, grandsons, and great-grandsons are liable to pay the private debts of their male lineal ancestors, provided these debts are untainted by immorality or illegality. Under the principle of *damdupat* (believed by one high court to be unconstitutional), Hindu debtors cannot be obliged to pay at one time more interest than the amount of the principal.

Hindu deities own property and are represented by their managers (*shebait*s), whose powers are limited. The property of an orthodox religious college (*math*; Sanskrit *maṭha*) is managed by the head, usually called a *mahant*, who has wide powers of disposal subject to Hindu law

and the applicable Religious Trusts Act.

Modern Hindu Law.—The Hindu Marriage Act (Act 25 of 1955), the Hindu Minority and Guardianship Act (Act 32 of 1956), the Hindu Succession Act (Act 30 of 1956), and the Hindu Adoptions and Maintenance Act (Act 78 of 1956) made profound changes in the Hindu law applicable in India. Caste distinctions and differences of custom were nearly abolished in the eyes of the law. Marriage was made compulsorily monogamous. Subject to a waiting period of three years, divorce became available on such grounds as adultery, incurable insanity, leprosy, failure to comply with a decree of restitution for two years, and nonresumption of cohabitation for two years after a judicial separation. Judicial separation was made available for such reasons as desertion for two years, adultery, and cruelty. An annulment was made available for impotence.

Under the new laws guardians may make substantial alienations of their wards' property only with the consent of a court. A married man may adopt with his wife's consent. A boy may be adopted provided no male issue is alive, and a girl may be adopted if no daughter or son's daughter is alive. Moreover, a female may now adopt to herself alone. Where the sex of the adoptee differs from that of the adopter, at least 21 years' difference in age is prescribed. An orphan may be adopted with the court's consent.

Legal limited estates have been abolished. While succession to males and to females remains distinct, the two are more nearly similar than under traditional Hindu law. Many close relations share the estate of a male who dies intestate; thereafter all agnates, including the widows of a few close agnates, take a share, followed by all cognates on a basis of propinquity. In most cases, a *Mitākṣarā* coparcener's interest devolves by testamentary or intestate succession, not by survivorship. Illegitimate children no longer share in an estate, but their maintenance is properly secured. Maintenance rights have been regularized, and females may be liable to maintain their children and aged parents. Conversion from Hinduism, however, is still penalized in various ways (for example, rights to alimony are thereby lost).

Islamic Law.—The system used elsewhere in the Islamic world is in force in India in family and religious matters, including wills, *waqfs* (religious or charitable trusts), and pre-emption, subject to certain special features. To distinguish it from pure sharia (Arabic *sharī'ah*; canon law), it is often called Muslim or Anglo-Muslim law. Indian Muslims who are Sunnites follow the Hanafite school of law, while those who are Shī'ites are of the Ithnā 'Ashariyah or Ismā'īliyah schools. Several communities, including the Khojas, the Memons of Kutch, the Moplas (Malayalam *Māppila*), and some Bohras, formerly were governed by Hindu rules relating to the joint family and succession, but since the passage of the Shariat Act (Act 26 of 1937; amended by Act 16 of 1943) they have been governed by personal law in almost all important matters. Until 1861 and 1871, respectively, Islamic law, repeatedly modified, had also been in force in matters relating to crime and evidence. The sources of Anglo-Muslim law are not the Arabic texts as a whole, but only those generally acknowledged in India at about 1772, particularly the *Hidāya* and the *Fatāwā-i 'Ālamgiri*.

Western remedies and procedure have modified and supplemented the *sharī'ah*. Nevertheless, Is-

lamic law, which had a detailed literature from the beginning and belonged to a community that was slower to become Westernized than the Hindus, changed less than Hindu law under British administration. Moreover, case law is relatively less abundant than that of Hindu law. A striking conflict between Western and Islamic notions arose over the question of whether *waqfs* which provided only a remote or illusory benefit for strangers were valid, and the Privy Council's decision was reversed by the Mussalman Wakf Validating Act of 1913.

Important reforms of the marriage law, importing certain Malikite doctrines into India, were made in the Dissolution of Muslim Marriages Act (Act 8 of 1939), whereby a wife's rights to divorce were strengthened. The Muslim Wakfs Act (Act 29 of 1954) attempted to curtail the traditional freedom of the mutawallis (Arabic *mutawalli*; *waqf* trustees) by compelling them to register and to submit accounts. Muslims of education and means have availed themselves of the Special Marriage Act of 1954 in order to obtain freedom of testamentary disposition, but by the 1960's no general movement for reform of Islamic law had been noted in India.

See also 15. *Government*.

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15. GOVERNMENT

As one of the two countries into which the former British Indian Empire was divided on Aug. 15, 1947, India was first established as a dominion. It became a republic on Jan. 26, 1950, when a constitution, drawn up by an indirectly elected Constituent Assembly and adopted on Nov. 26, 1949, was formally inaugurated. The dominion government had previously "affirmed India's desire to continue her full membership of the Commonwealth of Nations and her acceptance of the King as the symbol of the free association of its independent member nations and, as such, the Head of the Commonwealth." This meant, in effect, that India continued to take its full share in intra-Commonwealth consultations regarding defense, finance, and other matters, and that its citizens did not become aliens in other Commonwealth countries. Its position differs from that of such older Commonwealth countries as Canada only in the republican form of government and in the absence of formal allegiance to King George VI, and later to Queen Elizabeth II, as the sovereign in whose name all governmental acts are performed.

Government Under the Constitution.—India is a sovereign democratic republic and a union of states. Although the structure of the government is federal, its spirit is unitary. The 15 states have very limited powers as compared with the states composing such other federal unions as the United States of America, Canada, and Australia. As in Canada, residual power rests expressly in the central government. The 9 territories and other centrally administered areas possess no states' rights.

Central Government.—*Executive:* All executive action is taken in the name of a president who is a ceremonial head of state acting on the advice of ministers responsible to a majority in the lower house of the central legislature. The president is a citizen over 35 years of age elected

for a five-year term; he may be re-elected. He is chosen by an electoral college formed of the elected members of both houses of the central legislature and of the elected members of the legislatures of the states. Each member of the college casts a large number of votes, the exact number being determined by an elaborate method of calculation based on census figures for the population of each state. The problem of succession in the event of the president's death or disability is handled by the provision for a special presidential election within six months thereafter. A vice president, elected at a joint sitting of both houses of the central legislature, presides over the upper house; he acts as president only during the short interval prior to the special election. The provisions concerning the cabinet introduce no novelty into the normally accepted conventions of the British cabinet system except for the provision of a professional attorney general, a portfolio obviously intended for an eminent lawyer whose tenure need not be affected by the vicissitudes of parliamentary politics.

Legislature: The central legislature consists of not more than 750 members, 500 in a lower house called the House of the People (Lok Sabha), and 250 in an upper house called the Council of States (Rajya Sabha). The 500 members of the House of the People are chosen by universal adult suffrage in such a way that there is not less than one member for every 750,000 persons, or more than one for every 500,000. The lower house is subject to dissolution in accordance with usual British practice; it is considered dissolved at the expiration of five years unless a proclamation of emergency is then in force. A cabinet minister may not hold his post more than six months without a seat in either house. He may speak, but not vote, in the house of which he is not a member. Of the 250 members of the upper house, 12 are eminent citizens appointed by the president because of their achievements in literature, art, science, and other fields. The other members are elected by the elected members of the lower houses of the state legislatures. The upper house is not subject to dissolution, but the terms of the members are so arranged that one third expire every two years. Provisions for a joint sitting of both houses obviate the possibility of legislative deadlock.

Judiciary: There is one national judiciary depending on appointment by the central government and protected by the usual safeguards which ensure the independence of judges in Great Britain. Salaries cannot be reduced. Removal cannot be effected except by an address voted by two thirds of both houses of the central legislature on the grounds of proved misbehavior or incapacity. The Supreme Court of seven justices is the guardian and interpreter of the constitution.

State Governments.—*Executive:* The governor is appointed by the president (that is, by the national cabinet), and his dependence on the central government is designed to be close and intimate. He is not merely a ceremonial head of state who acts always on the advice of a state cabinet responsible to a majority of the lower house of the state legislature. There is such a cabinet, but the governor has power to reserve bills for the president's consideration and is given authority to act in his discretion to a considerable extent.

Legislature: The state legislative structure may be bicameral or unicameral. All state legis-

latures, with the concurrence of a majority of the central legislature, may decide to change from a bicameral to a unicameral system or vice versa. The powers exclusively within the state legislative sphere are limited to such matters as education, public order, and police. State legislatures would, however, exercise in practice many of the powers listed on the concurrent list of powers shared with the central legislature, such as criminal and civil procedure, marriage and divorce, probate, trusts, and contracts.

Judiciary: There is no state judiciary.

Bill of Rights.—The list of fundamental rights enforceable in the courts is comprehensive and follows a United States rather than a British model. Its most significant provisions may be summarized as follows. No titles may be conferred. "No person shall be deprived of his life or personal liberty except according to procedure established by law." There are specific provisions against double jeopardy, *ex post facto* laws, and bearing witness against oneself. The prohibition of untouchability is absolute. No citizen on the grounds only of religion, race, caste, or sex may be denied access to stores, hotels, restaurants, and places of public entertainment or to any well, tank, road, or place of public resort supported wholly or in part by public funds. Freedom of worship and equality of treatment of all religions by the state are provided for, but the state may regulate any "economic, financial, political, or other secular activity" associated with religious practice and may effect social welfare or reform by such measures as the opening of Hindu religious institutions of a public character to any class or section of Hindus. Citizens may assemble peaceably and without arms. The right of freedom of speech is qualified by the government's right to make any law relating to a matter which "offends against decency or morality or which undermines the security of or tends to overthrow the state." The central legislature

may by law prescribe the circumstances under which, and the class or classes of cases in which, a person may be detained for a period longer than three months under any law providing for preventive detention.

Amendment.—The following matters are protected against hasty constitutional amendment: (1) the allocation of legislative powers between the central government and the states; (2) the representation of the states in the central legislature; and (3) the powers of the Supreme Court and the high courts. An amendment touching these matters must be ratified by one half of the states, as well as by the central legislature (a majority of the total membership in each house and a majority of at least two thirds of the members present and voting being necessary for ratification). Amendments touching other matters may be effected by the central legislature voting as described above.

Emergency Provisions.—Faced with war or domestic violence (actual or potential), the president may issue a proclamation of emergency which enters into force at once but must be laid before the central legislature within two months. The central legislature may by resolution of both houses extend the period of emergency beyond the period of two months. While such a proclamation is in force, the central government may exert any degree of control over state governments, and the guarantees to individuals in the bill of rights may be largely suspended. If, upon receiving a report from a state governor, the president is satisfied that the peace and tranquillity of a state are threatened, he may proclaim an emergency in such state, whereupon he may virtually take over the state, suspend the legislature, and legislate for the state through the central legislature. Such a regime, if ratified within two months by the central legislature and every six months thereafter, may continue for as long as three years.

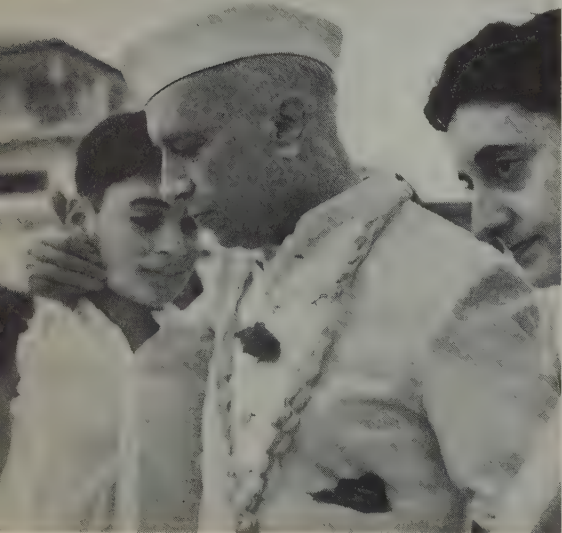
Policy Toward Minorities.—The constitution retained for a 10-year period provisions for reserved seats in the lower houses of the legislatures for certain scheduled tribes and scheduled castes (it was extended in 1959 to 1970). Moreover, the scheduled tribes of primitive peoples, numbering approximately 10 million, retain their special status with adequate guarantees against exploitation. Authority was given to the president and the governors to nominate to the lower houses of the central and state legislatures a few representatives of the Anglo-Indian (Eurasian) community. Not more than two such representatives may sit in the central legislature.

Provisions Concerning Language.—According to Article 343, "the official language of the Union shall be Hindi in Devanagari script" but "... for a period of fifteen years from the commencement of this Constitution, the English language shall continue to be used for all the official purposes of the Union for which it was being used immediately before such commencement." In 1963, Parliament extended the use of English as an official language for an additional 10-year period, to 1975.

The Constitution in Operation.—The Indian constitutional system underwent surprisingly little change during its first years. It is remarkable that the drastic changes that took place in the political map—the rapid integration of the former princely India and the former British India, culminating in a redrawing of state boundaries not

Prime Minister Nehru with his daughter and grandson.

Kulwant Roy



foreseen in 1950 and the incorporation of foreign enclaves—necessitated only five amendments to the constitution. The other nine amendments adopted by 1963 generally strengthened the hand of the central government. Apart from reapportionment as a consequence of the 1951 census, extension of special provisions for minority seats, adjustment of the border with Pakistan, a slight change in the procedure for election of the president and vice president, and provision for legislatures and councils of ministers in certain territories, these amendments related primarily to two matters: the facilitation of social reform, especially land reform; and the conferment of broader powers to restrict freedom of speech and writing which prejudices friendly relations with foreign states, public order, decency, and morality. The adding of several key commodities to the concurrent legislative list and the fixing of a procedure for settling disputes over compensation for landlords have enabled the central government both to prevent hoarding and to remove obstacles which formerly stood in the way of land reform projects planned in several states.

The selection of a respected elder statesman, Dr. Rajendra Prasad, as India's first president, has ensured that the presidency would remain, as the authors of the constitution intended, above partisan politics. When, in 1962, his successor was elected, the choice fell on the vice president, Dr. Sarvepalli Radhakrishnan, one of India's most distinguished philosophers. He in turn was succeeded in the vice presidency by a noted educator, Dr. Zahir Hussain.

In more than one instance since 1950 the central government has acted promptly to assume charge of the government of a state which was in the throes of political confusion and unable to form a stable ministry. Nothing has occurred since 1950 to strengthen the position of the states within the Union. The States Reorganization Act of 1956, involving a reduction of the number of states and the virtual disappearance of the princes from Indian public life, has increased the power and prestige of the central government.

Political Development Under the Constitution.—The course of political events, the general elections of 1951–1952, 1957, and 1962, and the evolution of India's political parties, as described in *19. History Since 1947*, throw much light on the nature of Indian politics. What chiefly strikes the foreign observer is that the republic's political system is basically a one-party system dominated by Pandit Jawaharlal Nehru, the surviving personality from the period of the struggle for independence, who symbolizes for the masses the achievement of nationhood and freedom. Yet the Congress Party is not the party of one man, nor is India a one-party authoritarian or police state rather than a parliamentary democracy. The three general elections have given a surprising demonstration of the workability of universal adult suffrage among a preponderantly illiterate population through the use of pictorial party symbols and a well-organized system of polling supervision. The politically conscious and largely English-knowing intelligentsia from which the republic's rulers are drawn has shown an ability to preserve the independence of the judiciary, the integrity of the civil administration, and the subordination of the military to the civil authority—three great bulwarks against the transformation of a parliamentary democracy into a dictatorship.

The continuance of the so-called one-party system in the central government is due primarily to two factors—one the survival of most of the Congress leaders who were the chief architects of independence, and the other the importance of personal leadership in Indian political life. Both factors are to some extent the consequence of the fact that in India, as in most Asian countries, the politically conscious form a tiny minority, most of whom are acquainted with each other. Indian political life before independence was characterized by much fluidity as between political groupings: politicians thought nothing of identifying themselves with more than one political following at the same time. Moreover, secessions from and returns to political groups were frequent, and were ways of expressing political discontent and of changing the character of a group or faction by ostracizing it until it yielded to criticism. During such periods of secession a popular political personality often offered himself as an independent and built up a personal following. Since independence this has been true especially in contests for seats in state legislatures, where the number of independent nonparty candidates has been truly astonishing. Hence a basically one-party system in India does not necessarily imply a monolithic system. The failure of a two-party system of the traditional British type to evolve during the first decades of Indian independence is a natural consequence of India's previous political history. The occurrence of political deadlocks in certain states, such as Andhra Pradesh, in which no party or group of parties could govern, and the success of non-democratic parties in winning control of a state government, as the Indian Communist Party did in Kerala from 1957 to 1959, indicate the dangers facing democratic government in India. Stable nonauthoritarian government does not require a two-party system, but it does require the continuance of a preponderance of agreement among the stronger Indian political groups as to the fundamental nature of the "sovereign democratic republic" established under the constitution on Jan. 26, 1950. See also *1. Political Divisions*; and separate articles on COMMONWEALTH OF NATIONS; NEHRU, PANDIT JAWAHARLAL.

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16. PREHISTORY

Early Indus Civilization.—The earliest known civilization in the Indian subcontinent dates back to the 3d and 2d millennia B.C. It has been found at a large number of sites uncovered by archaeological exploration in the area drained by the Indus River system as well as at other sites to the west and to the southeast. This area seems then to have received or conserved more moisture than in modern times, and harbored such marsh and jungle animals as the rhinoceros, buffalo, tiger, and elephant, all of which are frequently represented in art, while the camel is scarcely indicated. Preceding or contemporary with the Indus civilization were a number of relatively primitive cultures, differentiated mostly by pottery types and known as Nal, Amri, Zhob, Togau, Quetta, and Kulli (Kulli-Mehi), which have been discovered west of the Indus as far as Kerman Province, Iran.

The characteristic Indus civilization was first discovered at Harappa in the Punjab in what is now West Pakistan, and hence is called the Ha-

rappa civilization. Much the most advanced of all the ancient Indus cultures, it endured for the longest time and is the best explored. It has been found as far north as Rupar on the Sutlej River, in the former states of Bikaner and Bahawalpur, and at a profusion of sites in Sind, mostly west of the Indus, while a southern outpost appears at Rangpur in Kathiawar. The civilization contained two large cities—Harappa and Mohenjo-daro, in northern Sind—each more than three miles in circumference; some smaller cities, of which one, Chanhudaro in central Sind, has been well explored; and a number of villages. It was in contact with civilizations in Mesopotamia and the Iranian highland as early as 2350 B.C., but must have been in existence before then, and it continued at least as late as the 17th century B.C. and possibly later.

The architecture of the Harappa civilization was of brick, and the cities were planned, the principal streets being carefully oriented. Harappa and Mohenjo-daro each had a walled citadel and may have been the capital of a large kingdom. Both they and Chanhudaro possessed elaborate public drainage systems. The houses were usually separate and equipped with baths, their drainage connecting with the public system. The people used copper and bronze extensively, wore cotton clothing, and had jewelry of shell, pottery, gold, and beads of various kinds, of which the most noteworthy were made of etched carnelian. Both cubical and tabular dice have been recovered. The civilization had a system of writing, which appears abundantly in short inscriptions on steatite seals and occasionally on pottery and metal but has not been successfully deciphered. The economic, social, and political structure is unknown, but the cities were commercial and there were wide variations of wealth. While weapons and missiles have been found, we can reconstruct very little of the Harappan art of war. There are surviving stone and bronze sculptures, pottery figurines, many carved seals, and a vast amount of painted pottery. The thick-walled, red, wheel-made Harappa pottery has a characteristic black painted decoration of animal, foliage, and geometric motifs. A number of motifs in Harappan art are paralleled in contemporary western Asia, and others reappear 1,000 years or more later in historic India, but the connecting links have not been found. What people owned this civilization is not known, but it is frequently suggested that they were Dravidian.

Following the Harappa civilization came the Jhukar civilization, with towns sometimes built upon Harappan remains but with less competent architecture. This civilization had no writing. It is distinguished by its own type of polychrome painted pottery. While we do not know how either it or the Harappa civilization before it came to an end, suspicion has been cast upon the relatively uncultured Aryan invaders of the 2d millennium B.C. as its destroyers. At an undetermined interval after the Jhukar civilization a primitive culture known as Jhangar, otherwise unidentified, existed in the lower Indus Valley. It is characterized by a gray, incised pottery.

Early Vedic Civilization.—The next epoch in the history of civilization in the subcontinent is that of the penetration and early spread of the people who composed the Rig Veda (*Rgveda*) and other early Vedic works for use in their religious ritual. All our information about them is literary, drawn from their texts without supple-

ment from material remains. The Vedic people spoke an early form of Sanskrit, called themselves *Arya* (noble), and were closely related in language and other phases of culture to the Iranians, forming with them a subgroup of the Indo-Europeans termed Indo-Iranian or Aryan. They are generally considered to have entered the subcontinent through the passes of the northwest frontier at around 1500 to 1200 B.C.

The Aryans were nomadic, and the cow was their unit of value, but they also raised crops, especially barley. They had fortified settlements, used metals, wore helmets and body armor, and may have introduced the horse into the subcontinent, though some horse bones have been found in late Harappa remains. Their most prized weapon was the bow. They gambled with *vibhidaka* nuts in place of dice, and had an intoxicating drink called *sura* (Sanskrit *surā*).

Aryan society was patriarchal and was divided into (1) Aryans, who were subdivided into the Brahmins (*Brāhmaṇa*) or spiritual aristocracy, the Kshatriyas (*Kṣatriya*) or Rajanyas (*Rājanya*), rulers and warriors, and the Vaisyas (*Vaiśya*; Sanskrit *Vaiśya*) or commons; and (2) non-Aryans called Sudras (Shudras; Sanskrit *Sūdra*) or serfs. The Aryans were organized in clans or tribes, each ruled by a king or *raja* (Sanskrit *rājan*). There was an assembly of the free folk. The Rig Veda contains references to wars between tribes, but little history can be reconstructed.

The land of the Rig Veda is the eastern Punjab; the Jumna and Ganges rivers and the region between them are barely known to that work, and there is no information about the means and stages by which the Aryans progressed from the Punjab to the east and south. By about 1000 B.C., however, they seem to have advanced into the plains of northern India, in modern Uttar Pradesh, and by about 800 B.C. to have reached Bihar and the western part of Bengal. They may also then have got to the central part of India, coming down from the Gangetic Valley, and in the west to have descended the Indus, crossed Kutch, and arrived in Gujarat.

Formation of Historic Indian Civilization.—The first blending of the diverse elements which formed historic traditional Indian civilization took place from the 7th to the 3d century B.C. For this period archaeological exploration has revealed much information on topography, cultural developments, and social conditions, which supplements the data in late Vedic literature and the Buddhist and Jain traditions. Aryan civilization, as modified by contact with non-Aryan culture, established itself in north India, and there are presumptive reasons for thinking that a Dravidian civilization existed simultaneously in south India. In these same centuries the Brahmanic philosophic speculations embodied in the Upanishads (*Upaniṣad*) and the two heterodox faiths of Buddhism and Jainism, which developed in north India, spread abroad. The Achaemenid dynasty of Persia came into contact with India in the 6th century B.C., and in the inscriptions of its kings we get our first dated documents of Indian history.

See also 2. *The People—Prehistoric Cultures*; 11. *Literature—Classical Literature*; 13. *Religion and Philosophy—Religion and Philosophy of Indian Origin*; and separate articles on ARCHAEOLOGY—Old World (Neolithic and Later); India and Pakistan; PAKISTAN—7. *Architecture*

and Art; VEDIC LITERATURE.

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17. HISTORY: 6TH CENTURY B.C.—1707

Pre-Gupta India, 6th Century B.C.—4th Century A.D.—While it is not possible to present a definite picture of the political condition of India before the 6th century B.C., it is known that there were then no less than 16 important states in northern India. Some of these states, like those of the Lichchavis, Sakyas (Śākyas), and Mallas, were republics, while others, such as Kosala (modern Oudh), Avanti (Malwa), Vatsa (the region round Allahabad), and Magadha (southern Bihar) were monarchies. Under a succession of able rulers like Bimbisara (r. about 543–491 B.C.) and his son Ajatasatru (r. about 491–459 B.C.), Magadha gradually became the most powerful. In the mid-4th century B.C., a Sudra named Mahapadma Nanda usurped its throne. By a series of brilliant military campaigns he made himself master of an empire extending from the Brahmaputra River on the east to the Beas River on the west.

The region west of the Beas, which was still divided into a number of small states, fell an easy victim to foreign invaders. Darius I, the Achaemenid king of Persia, conquered part of it toward the close of the 6th century B.C., and Alexander the Great led his victorious army as far as the Beas in 327–325 B.C. Alexander died in 323 B.C., and the Greek garrisons he left behind were driven from the Punjab by Chandragupta of the Maurya clan (r. about 321–297 B.C.), who also defeated the Nanda ruler of Magadha. Chandragupta thus founded an empire which embraced nearly all of northern India and probably included lands farther south. Its capital was Pataliputra (modern Patna). Seleucus I Nicator, the able general who took possession of Alexander's eastern dominions, led an expedition in 311 B.C. to recover the lost territories in the Punjab. It failed, however, and about 304 B.C. the two rulers concluded a treaty whereby, in exchange for 500 elephants, Seleucus ceded to Chandragupta nearly all of the region comprised in modern Afghanistan and Baluchistan. Not much is known about Chandragupta's son and successor Bindusara (r. about 297–274 B.C.), but the latter's son Asoka (Ashoka; Sanskrit Aśoka) was the greatest ruler of ancient India.

Reign of Asoka, c. 274–237 B.C.—Aśoka is the first Indian ruler of whose life and reign we possess fairly full and accurate information from inscriptions, more than 30 of which have been found engraved on rocks and pillars from Mysore in the south to Afghanistan in the northwest. He had inherited an empire which extended to the Hindu Kush in the northwest, and included almost all of modern India and Pakistan with the exception of the petty Tamil kingdoms in the south and Kalinga (modern Orissa) on the east coast. In the ninth year of his reign he led an expedition against Kalinga, which was conquered after a sanguinary war. According to Asoka's own account, "150,000 were captured, 100,000 were slain, and many times as many died" in the course of the campaign.

The sight of this bloodshed changed the tenor of Asoka's life. Converted to Buddhism with its doctrine of ahimsa (Sanskrit *ahimsā*, noninjury of living creatures), he forswore war and, in-

stead, devoted himself and the resources of his empire to the propagation of the precepts and doctrines taught by the Buddha. He organized a network of missions which spread Buddhism not only throughout the subcontinent of India, but also to Ceylon and probably to Southeast Asia as well. His missionaries are known also to have visited the rulers of the Hellenistic principalities of western Asia, northern Africa, and eastern Europe, five of whom are named specifically in his records. It was due mainly to Asoka's efforts that Buddhism, which had been merely a local Indian sect, gradually developed into a world religion. While his earthly empire perished long ago, his name is honored today by Buddhists in many lands.

Asoka's inscriptions testify to his high conception of royal duties and to his humanitarian principles. He was untiring in his efforts to help his subjects both materially and spiritually, and he not only preached but practiced religious toleration. Moreover, he made notable contributions to the development of Indian architecture and art.

India After the Death of Asoka.—With Asoka's death the Maurya Empire began to disintegrate. Very little is known about the next seven kings of the dynasty, the last of whom was killed about 184 B.C. by his commander in chief, Pushyamitra, who founded a new dynasty called the Sunga (Sunga, 184–72 B.C.). By this time the northwestern frontier was again exposed to foreign invasions.

The empire which Seleucus had founded from the eastern portion of Alexander's conquests included Bactria, beyond the Hindu Kush, which revolted about 250 B.C. under its governor, Diodotus I. At the beginning of the 2d century B.C., the Greek rulers of the new kingdom of Bactria began to invade India from the northwest. Some of them—Demetrius I, Apollodotus I, Menander—advanced far into the interior, and although Pushyamitra succeeded in repelling invasions of central and eastern India, more than 20 Greek princelings are known to have ruled over small states in the Punjab and Afghanistan.

Other foreigners soon followed the Greek example. The Parthians, the Sakas (Śakas), and lastly the Kushanas (Kuşāṇas), a branch of the Yuechi (Yüeh-chih), all entered India from the northwest and fought one another. While the rule of the Greeks and the Parthians was extinguished by the 1st century A.D. and that of the Sakas was confined to Gujarat, Kanishka (Kanishka), the most powerful of the Kushana kings (fl. 1st or 2d century A.D.), ruled over an empire that extended as far as Banaras in the east and included large parts of Afghanistan and central Asia.

Meanwhile, the rest of northern India was divided into a large number of independent monarchies and republics. Kharavela, ruler of Kalinga (fl. 2d or 1st century B.C.), invaded northern India several times, and may have fought the Greeks. Another powerful kingdom was founded in the Deccan, probably in the 2d century B.C., by Simuka, a member of the Andhra Satavahana (Śātavāhana) family. Its capital was Pratihasthana (modern Paithan), on the Godavari River. The Satavahanas ruled for four and a half centuries—longer than any other dynasty of ancient India. Gautamiputra Satakarni, the most powerful king of the family (fl. early 2d century A.D.), claimed in inscriptions to have defeated the Sakas,

Yavanas (Greeks), and Pahlavas (Parthians). The Satavahanas, who thus defended the south against foreign intruders, were also great patrons of art and literature, and their memory is cherished in the legends of King Salivahana (a form of Satavahana).

Farther south, beyond the line of the Krishna (Kistna) and Tungabhadra rivers, flourished the principalities of the Cheras, Cholas, and Pandyas (Pāṇḍya), who occupied respectively the western, eastern, and southern parts of the Tamil country. Their constant wars, resulting in the occasional supremacy of one principality over the two others, are described in Tamil literature. Many legends have clustered around such powerful kings as Karikala (Karikkal) Chola and Nedunjeliyan Pandya. Some time before the 4th century, A.D., however, a new dynasty, the Pallava, conquered the region around Kanchi (modern Kanchipuram or Conjeeveram) and within a short time established its supremacy in the Tamil area.

Gupta Period, 4th to 6th Century A.D.—A new dynasty, called the Gupta, rose to power early in the 4th century A.D. and reunited a large part of India. Chandragupta I (r. 320–?330), originally the ruler of a petty principality in southern Bihar or northern Bengal, conquered a number of neighboring states and established a powerful kingdom with its capital at Pataliputra, the old imperial city of the Mauryas. Assuming imperial titles, he founded an era beginning in 320 A.D., which was probably the date of his accession. It was his son and successor, Samudragupta (r. about 330–375/380), who brought the dynasty to the height of its greatness. Samudragupta, the hero of 100 battles, has been called the Napoleon of India. By annexing the states of a number of kings whom he defeated in northern India, he extended the territory under Gupta administration to the Jumna and Chambal rivers on the west and to the Narbada River on the south. In addition, several states beyond these boundaries acknowledged his suzerainty. Samudragupta also undertook a military expedition to southern India, advancing along the east coast as far as the Pallava kingdom of Kanchi. While he defeated about a dozen south Indian kings, they were permitted to retain their thrones, presumably as vassals of the Gupta Empire.

Chandragupta II (r. 375/380–c. 413), the son and successor of Samudragupta, defeated the Sakas and annexed Gujarat, thus removing the last traces of foreign rule in India. He also probably led his victorious army beyond the Indus River as far as Balkh and imposed his suzerainty over the Kushana principalities in the northwest. His son, Kumaragupta I (r. about 413–455), maintained intact the vast empire, which now extended from the Bay of Bengal to the Arabian Sea. Toward the close of his reign the Huns invaded India from the northwest, but the crown prince, Skandagupta, inflicted such a crushing defeat on them that for nearly half a century India was saved from their raids. Skandagupta himself had a short reign, and his death, which occurred about 467, seems to have been followed by a struggle for succession, from which Budhagupta emerged victorious and ruled until nearly the end of the century. Budhagupta's death was a signal for internal dissension, and the Huns reappeared on the northwestern frontier. Between about 500 and 528 two Hun chieftains, Toramana and Mihirakula, advanced as far as Malwa, and although a Gupta king, Narasimha-

gupta, and a feudatory chieftain, Yasodharman, both claim to have defeated Mihirakula, the Huns could not be dislodged from India. By about 530 A.D., Yasodharman established his authority over the entire empire, but by the mid-6th century both he and the Gupta Empire had been brought to a common ruin.

The Gupta period is known as India's golden or classical age. It was during this period that art, literature, and science reached the highest levels, setting a standard which was alike the ideal and the despair of Indians in later times. The Chinese pilgrim Fa-hsien, who was in Gupta dominions from 405 to 411, has left us his impressions of the empire at its height.

Post-Gupta Period, 6th to 8th Century.—The Gupta Empire perished, but the memory of its greatness survived. While northern India was again divided into a number of independent principalities during the next two centuries, able kings attempted repeatedly to re-establish political unity. Some were temporarily successful, but the empires they founded did not survive their deaths. The first of them was Sasanka, king of Bengal at the beginning of the 7th century, who led his victorious army as far as Kanauj in the west and the Ganjam District of Orissa in the south. The next was Harsha (Harshavardhana, r. 606–?647) of Thanesar and Kanauj, who was able to establish his authority over a large part of northern India, although he was defeated (c. 620) by Pulakesin II, the Chalukya king of the Deccan. While Harsha's empire also ended with his death, he is better known than the others because the Chinese pilgrim Hsüan-tsang traveled in India for 15 years during Harsha's reign and has left a graphic account of his activities. Half a century later another ruler of Kanauj, Yasovarman (r. about 700–740), made extensive conquests but was defeated by Lalitaditya, king of Kashmir (r. 724–760), who also established an empire which perished after his death.

Meanwhile, momentous developments were taking place in the Middle East. The Prophet Mohammed, who died in 632 A.D., had not only established a new religion, Islam, but had made the Arabs a militant nation. By 650 they had overrun the Persian Empire, Syria, and Egypt and had advanced as far as the Oxus River (Amu Darya). While they naturally cast longing eyes on India, their early efforts at conquest were not successful. Between 637 and 644 they sent three naval expeditions to the subcontinent, and between 650 and 700 several military expeditions were dispatched by land to Kabul, Zabul, and Sind. Finally, after more than half a century, they conquered Sind in 712. From this base the Arabs tried to reach Kashmir and Kanauj, but they were checked by Lalitaditya and Yasovarman. Some time between 724 and 738, Junayd, the Arab governor of Sind, advanced as far as Malwa and Gujarat, but his forces were repulsed by the Pratihara ruler Nagabhata I and the Chalukya governor of Gujarat.

Northern India, 8th to 10th Century.—*Rivalry of the Pratiharas, Palas, and Rashtrakutas.*—The Pratihara (Pratihāra) ruler Nagabhata I (r. about 730–760) who defeated the Arabs was a member of the Gurjara tribe and the founder of a dynasty which became very powerful in Rajasthan toward the close of the 8th century. In their efforts to build an empire in northern India the Pratiharas found a formidable rival in the Palas (Pāla), who had established

their power over Bengal and Bihar. Since the death of Sasanka, Bengal had been conquered by a succession of foreign rulers and had fallen into a state of political disintegration. There was no central authority, and local chieftains constantly fought one another. At last, roused to a sense of duty by the miserable condition of Bengal, these chieftains, by a heroic resolve unique in Indian history, surrendered their power to one of their number, Gopala, whom they elected in about 750. Gopala reunited Bengal, whose prosperity he restored, and became the founder of a long line of kings whose names ended in *pāla* (protector), and which is consequently known as the Pala dynasty.

At the same time a new power arose in the Deccan. The Satavahanas, who had ruled this region until the early part of the 3d century, were replaced in the 4th and 5th centuries by the Vakatakas (Vākātaka), and they in turn were succeeded by the Chalukyas (Chālūkyā), who established a powerful kingdom, with Badami as its capital, in about the mid-6th century. The greatest king of this dynasty was Pulakesin II (r. 609/610–642), who extended his domains as far as Mysore in the south and Malwa and Gujarat in the north, and defeated Harsha and the Pallava king Mahendravarman I (r. 600–630). The next Pallava ruler, Narasimhavarman (r. 630–668), retaliated by defeating Pulakesin in 642 and by occupying his kingdom for 13 years. Although Pulakesin's son recovered the kingdom, the Chalukyas were overthrown in about 753 by the Rashtrakutas (Rāstrakūṭa). The Rashtrakutas not only defeated the Pallavas and the Western Gangas of Mysore, but two of their kings, Dhruva (r. 780–793) and his son Govinda III (r. 793–815), led successful expeditions against their northern neighbors.

Thus toward the end of the 8th century there was a triangular struggle for supremacy in northern India among the Gurjara Pratiharas of Malwa and Rajputana, the Palas of Bengal and Bihar, and the Rashtrakutas of the Deccan. The Pratihara kings Vatsaraja (r. about 775–800) and his son Nagabhata II (r. about 800–833) won great victories over the Palas, but in turn suffered serious reverses at the hands, respectively, of the two Rashtrakuta kings, Dhruva and Govinda III. Dharmapala (r. about 770–810), the son and successor of Gopala of Bengal, also submitted to Govinda, who advanced as far as the Himalaya but soon returned to the Deccan because of internal difficulties in his kingdom. Taking advantage of this situation, Dharmapala led a victorious army as far as Kangra in the northwest. He was consecrated emperor at Kanauj in the presence of rulers whom he had subjugated, and is referred to in later literature as lord of Uttara-patha (northern India). His son and successor, Devapala (r. 810–854), claimed supremacy over all of northern India from the Himalaya to the Vindhya Range.

After the death of Devapala the Gurjara Pratiharas once more came to the fore. Mihira Pratihara (called Bhoja, r. about 836–890), the greatest ruler of the dynasty, after initial failures succeeded in establishing his authority over most of northern India. His son Mahendrapala (r. about 890–910) penetrated the heart of Bengal itself. The Pratihara Empire, with its capital at Kanauj, now extended from northern Bengal to the Kathiawar peninsula, and a single imperial writ ran from the Arabian Sea almost to the Bay of Bengal. The word *pratihāra* means "door-

keeper," and the Pratihara kings justified their name by successfully barring the gates against the advance of Muslims from Sind and Multan.

Decline of Indian Power and the Muslim Invasions.—By the mid-10th century the Pratihara Empire showed signs of decline. One by one its feudatory chieftains declared their independence, and soon northern India was once more divided into a large number of principalities. Among the more prominent were those of the Chandellas in Bundelkhand, the Kalachuris in the vicinity of Jubbulpore, the Paramaras (Paramāra) or Pawars in Malwa, the Chaulukyas in Gujarat, the Chahamanas (Chāhamāna) or Chauhans in Jai-pur and Ajmer, and the Tomaras in the region around Delhi. They were the progenitors of the Rajput (Rājput) families who distinguished themselves in medieval times, but they were not as yet known by that generic name. Other contemporary powers included the old Pala kingdom of Bengal and Bihar; and the Hindu Shahiya (Shāhiyā) kingdom in western Punjab and Afghanistan, which had been founded by the Brahman minister of the last king of a dynasty which traced its descent from Kanishka.

Northern India had thus reverted to the condition that invariably followed the downfall of an empire. Nevertheless, the idea of restoring political unity persisted, and such powerful individual rulers as the Chandella kings Yasovarman (r. about 930–950) and Dhanga (r. about 950–1002) and the Paramara king Vakpati II (known as Munja; r. about 972–995) attempted to establish empires. Left to themselves, these powers might again have achieved imperial unity, but that was not to be. The small Turkish Muslim kingdom of Ghazni proved too formidable an enemy.

The Hindu Shahiya king of Afghanistan and western Punjab, Jayapala (Jaipal), who was resolved to crush the new power threatening India, succeeded in organizing a confederacy for the purpose, but it was defeated near Jalalabad (988) by Subuktigin (Sabuktigin), the ruler of Ghazni. After Subuktigin died in 997, Jayapala made a second attempt to drive out the Ghaznavids, but he was defeated and captured near Peshawar by Subuktigin's son Mahmud. Mahmud of Ghazni, who was the greatest general of his time, established his authority in Balkh, Herat, and Khurasan and invaded India at least 12 and possibly 17 times. He defeated a second confederacy of Indian rulers organized by Jayapala's son Anandapala (Anandpal). His raids, which were made almost every year in the cold season, were generally directed against the rich Indian temples, which he desecrated and plundered. Those Hindus who refused to embrace Islam were ruthlessly massacred. Then, at the advent of spring, Mahmud returned to Ghazni with a rich booty and innumerable slaves, including artisans to build and decorate his capital. He annexed the Punjab to his kingdom, and although the rest of northern India remained independent, its resources in men and goods were depleted.

The Deccan and Southern India, 10th to 13th Century.—The region south of the Vindhya Range, which was not affected by the invasion of Mahmud, pursued its normal course of development. In the Deccan the Rashtrakutas were supplanted by the Chalukyas, who claimed descent from the earlier royal family of the same name but ruled from a different capital, Kalyani. They are therefore known as the Later Chalukyas or the Chalukyas of Kalyani. In the far south the

Pallavas had been displaced in the 9th century by the Cholas of Tanjore, who soon became the dominant power of the region. Under two able rulers, Rajaraja I the Great (r. 985–1014) and his son Rajendra Chola I (r. 1014–1044), the Cholas defeated the Later Chalukyas, the Pandyas, and the Cheras; sent victorious armies along the Bay of Bengal as far north as the Ganges River; and conquered Ceylon and the Laccadive and Maldiv Islands. Their most remarkable achievement was a successful naval expedition against the Sailendra (Sailendra) rulers of the Malay Peninsula, Sumatra, and Java. The Cholas distinguished themselves in many other ways. They introduced an efficient administrative system based on local democratic self-government and an extensive land survey. In addition, the Chola kings were magnificent builders, and the Brihadiśvara Temple still stands in Tanjore as a monument to their greatness.

By the mid-13th century the Pandyas of Madurai had broken the power of the Cholas and had become the dominant power in southern India. Meanwhile, in about 1190, the Later Chalukyas of the Deccan also were ruined. They were supplanted by three new powers, the Hoysalas (Hoyśāla) of Mysore, the Yadavas (Yādava) of Deogiri (Devagiri, modern Daulatabad), and the Kakatiyas (Kākatīya) of Warangal. These three powers and the Pandyas constantly fought one another, oblivious of the catastrophe that had overtaken northern India.

Northern India, 11th and 12th Centuries.

—The political situation in northern India in the 11th and 12th centuries changed in only three respects: (1) the Hindu Shahiya kingdom now formed part of the kingdom of Ghazni; (2) the Gahadavalas (Gāhaḍavāla) or Gaharwars replaced the Pratiharas, who had been extinguished by Mahmud; and (3) the Pala dynasty of Bengal was supplanted in the 12th century by the Senas. With the other principalities of northern India, the Senas and the Gahadavalas pursued the old policy of struggling among themselves for supremacy. There were some powerful individual rulers, but they made no concerted effort to drive the Ghaznavids from the Punjab and so prevent the conquest of the rest of northern India. This could have been accomplished easily when the kings of Ghazni were defeated by the rulers of the neighboring Muslim kingdom of Ghor or Ghur, and the Ghurids sacked Ghazni itself (1151) and forced its rulers to take shelter in the Punjab. The Chahamanas king Prithviraja (r. 1178–1192), then the most powerful Indian ruler, ignored these opportunities and, instead, fought other Indian princes. Even when Muhammad Ghuri, who had ascended the throne of Ghazni in 1173, captured the last Ghaznavid ruler and made himself master of the Punjab (1186), Prithviraja was indifferent. It was not until Muhammad Ghuri began to raid his frontiers that the Chahamanas ruler realized his grave danger. He thereupon organized a great confederacy of Indian rulers and, in the First Battle of Tarain (Taraori, 1191), inflicted a major defeat on Muhammad Ghuri. The Ghurid forces were routed, and their king, severely wounded, returned to Ghazni. Nevertheless, Prithviraja took no advantage of this opportunity and made no attempt to conquer the Punjab. A year later, Muhammad Ghuri returned with a picked army and met Prithviraja at the same battlefield of Tarain. While Prithviraja fought bravely, he fell a victim to a clever ruse and was defeated and

killed. The Hindu army was routed.

The second Battle of Tarain must be regarded as one of the decisive battles of the world, for it paved the way for the Muslim conquest of India. Muhammad Ghuri followed up his victory by other successful campaigns, the most notable being the defeat inflicted in 1193 on the Gahadavala king Jayachandra (Jaichand), by which Muslim territory was extended to the borders of Bengal. Muhammad Ghuri spent most of his time at Ghazni, leaving the task of completing the conquest of northern India to his lieutenant, Qutb-ud-Din Aibak. In 1206, while returning from one of his occasional campaigns in India, he was assassinated on the bank of the Indus. Henceforth, Qutb-ud-Din ruled as an independent king in India. Assuming the title of sultan, he fixed his capital at Delhi.

Delhi Sultanate, 1206–1526.—*Slave Dynasty, 1206–1290.*—Qutb-ud-Din, the first sultan of Delhi (r. 1206–1210) put down Hindu rebellions and conquered some new territory. His son-in-law Iltutmish (Altamsh, r. 1211–1236), who succeeded to the throne after a brief interval, successfully maintained the new sultanate by repelling a Mongol invasion from the northwest, crushing Hindu resistance, and adding to his territory. His death provoked a struggle for the succession, during which an aristocracy of 40 Turks who had begun their lives as slaves (as had Qutb-ud-Din and Iltutmish themselves) wielded actual power. A daughter of Iltutmish, Raziyya (r. 1236–1240), fell a victim to a court conspiracy, and the dissension continued until one of the 40, Ghiyas-ud-Din Balban, took control, first as deputy of the nominal ruler, Iltutmish's son Nasir-ud-Din Mahmud (r. 1246–1266), and then as his successor and sultan *de jure* (r. 1266–1287). Ghiyas-ud-Din restored order by suppressing rebellions and by curbing the power of the slave aristocracy. Wisely he consolidated Muslim dominions instead of conquering new lands, and he secured the northwestern frontier against the Mongols by building a chain of strongly garrisoned forts. He enhanced the prestige of the court and made Muslim rule in India strong and stable. His successor, Kaiqubad, a worthless debauchee, was killed by one of the Khalji (Khalji) nobles, whose leader ascended the throne in 1290 under the title of Jalal-ud-Din Firuz Shah.

Khalji Dynasty, 1290–1320.—Jalal-ud-Din Khalji (r. 1290–1296) was treacherously murdered by his nephew and son-in-law, Ala-ud-Din (r. 1296–1316), who proved to be one of the greatest Muslim rulers of India. Ala-ud-Din conquered all of the Hindu kingdoms in northern India which had hitherto defied the Muslims—those of the Paramaras of Malwa; the Rajputs of Mewar; and the Vaghelas (Vāghela) of Gujarat, who had replaced the Chalukyas—and incorporated their territories in the Delhi Sultanate. A new Mongol invasion caused him to reorganize the northwestern defenses. Once he had completed the conquest of northern India, Ala-ud-Din sent several expeditions under his general Malik Kafur to the Deccan and southern India. Kafur defeated the Yadavas of Deogiri, the Kakatiyas of Warangal, the Hoysalas of Mysore, and the Pandyas of Madurai, and the victorious banner of Islam was carried to the southernmost point of the peninsula. While Ala-ud-Din annexed the Yadava kingdom, whose rulers had repeatedly rebelled against him, he was satisfied to exact tribute from the other three principalities. He organized a powerful

INDIA

Top right: Burning effigies at a Dasha-hara festival symbolize the defeat of evil.

Center: A Jaipur silverworker hand tools an ornate silver receptacle.

Below: Traditional bamboo scaffolding is used by workers engaged in new building.

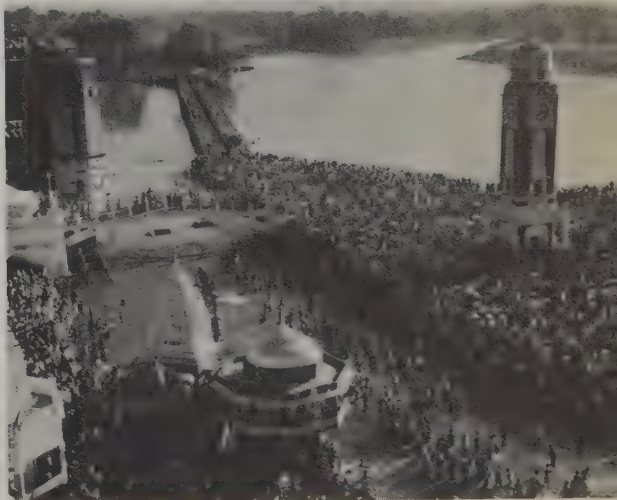
(Top right and top center) Kulwant Roy; (below) Gordon N. Converse, "The Christian Science Monitor"



Werner Bischof from Magnum

Above: Woman drawing water from a village well in central India.

Below: Hindus bathing in the sacred Ganges during Kumbh Fair.
Kulwant Roy



standing army and replaced the former system of military feudalism by a strong, centralized government. Despite his great victories and successful administration, Ala-ud-Din was an illiterate, vain, and cruel man. He declared himself a second Alexander and even aspired to be the prophet of a new religion. Excesses ruined his health, and in 1320, four years after his death, his dynasty was overthrown by Ghiyas-ud-Din Tughluq.

Tughluq Dynasty, 1320–1414.—Ghiyas-ud-Din, who died after a reign of five years, is generally believed to have been murdered by his son Muhammad Tughluq (r. 1325–1351). The most contradictory personality among the Muslim rulers of India, Muhammad was an excellent scholar, a fine writer, an eloquent orator, and a great general. But he was also extremely cruel, and he exacted for all crimes, great or small, the death penalty, which was sometimes inflicted with a revolting barbarity. Muhammad adopted a number of visionary projects, such as the transfer of the capital from Delhi to Deogir (renamed Daulatabad) in 1327, the substitution of token copper and brass currency for gold, and the attempted conquest of Khurasan. All of them were costly failures which brought great misery to the people. In certain areas bad conditions were worsened by inordinate increases in taxation. The revolts which broke out were generally put down with savage cruelty, but some of them were successful. By the time Muhammad died, all of India south of the Vindhya Range had shaken off the suzerainty of Delhi, and two powerful new kingdoms had arisen: the Muslim Bahmani kingdom in the Deccan and the Hindu kingdom of Vijayanagar in the south. In addition, Bengal had declared its independence.

Firuz Tughluq (r. 1351–1388), who succeeded Muhammad, made two unsuccessful attempts to recover Bengal but did not try to regain the southern provinces. His long reign was distinguished by the foundation of a number of cities; the digging of irrigation canals, some of which still exist; and the construction of parks, hospitals, bridges, and other public works. The prosperity of the sultanate was restored, and an effective system of administration was instituted.

Firuz was succeeded by incapable rulers whose reigns were marred by interminable wars of succession, of which the provincial governors took advantage to become *de facto* independent rulers. At this juncture, India was invaded by Tamerlane (Timur), who carried fire and sword as far as Delhi in 1398–1399. He gave the death blow to the Turkish Empire in India, which was now divided into such independent principalities as Bengal, Jaunpur, Malwa, Khandesh, Gujarat, and the Hindu states of Mewar and Orissa in the north, the Muslim Bahmani kingdom in the Deccan, and the Hindu kingdom of Vijayanagar in the south. The history of these independent states, some of which produced remarkably able rulers, really constitutes the history of India during the 15th and the first half of the 16th century.

Sayyid and Lodi Dynasties, 1414–1526.—What remained of the Delhi Sultanate (the Jumna Valley and the Punjab) was acquired in 1414 by Khizr Khan Sayyid, whom Timur had appointed governor of his Indian possessions. The Sayyid dynasty was overthrown by an Afghan chieftain, Bahlul Lodi, in 1451. The Lodi rulers showed some vigor and, after a 30-year struggle, recovered Jaunpur. Nevertheless, internal dissension, caused by a dispute between Ibrahim Lodi

(r. 1517–1526) and his unruly Afghan nobles, sapped the strength of the sultanate, and on the invitation of some disaffected nobles, Babur (Baber, real name Zahir-ud-Din Muhammad), ruler of Kabul, invaded India. After defeating Ibrahim Lodi in the First Battle of Panipat (1526), he took possession of Delhi and Agra.

Mughul Empire, 1526–1707.—The dynasty founded by Babur is known as the Mughul (Mogul), for although he was descended on his father's side from Tamerlane, his mother belonged to the family of the Mongol conqueror Genghis Khan. Shortly after his victory at Panipat, Babur faced the opposition of the brave Rajputs led by Rana Sanga of Mewar, but he obtained another brilliant victory at the Battle of Khanua (1527). In both of these battles he enjoyed the advantage of artillery, with which his opponents were unacquainted. Before he could consolidate his dominions, however, he died (1530) and was succeeded by his son Humayun.

The new king could not cope with Sher Shah, an Afghan chieftain of humble birth who had made himself powerful by sheer ability. Sher Shah seized Humayun's throne and brought nearly all of northern India under his control. His death after a brief reign (1540–1545) enabled Humayun, who had taken refuge in Persia, to return to India and to recover his kingdom in 1555. He died within a year, however, and the Afghans again seized Delhi. Under the able guidance of Bairam Khan, Humayun's son Akbar, then only 14 years old, defeated the Afghans in the Second Battle of Panipat (1556) and finally established Mughul supremacy in northern India.

Akbar was the greatest Mughul emperor. During his long reign (1556–1605) he conquered Malwa, Gujarat, Gondwana, Bengal, Kashmir, Khandesh, Berar, and other provinces and won over the Rajput states by a policy of conciliation and matrimonial alliances. (The premier Rajput chieftain, Rana Pratap Singh of Mewar, refused to submit, however, and waged a lifelong war against Akbar.) Akbar had many great qualities. Not only was he an excellent general and a sound administrator, but he displayed religious tolerance far in advance of his time. He assembled at his court representatives of different religions, whose discourses he enjoyed. By abolishing the *jizyah* (poll tax imposed on Hindus) and appointing Hindus to high civil and military office, Akbar won their hearts, and the Hindu Rajputs became the strongest pillars of the Mughul Empire.

Jahangir (r. 1605–1627), the son and successor of Akbar, married the beautiful and talented Nur Jahan after ascending the throne, and he left affairs of state mostly in her hands. Mewar was finally conquered and Kangra was captured during his reign, but the strong fort of Kandahar fell to the Persians (1625).

Jahangir's son Shah Jahan (r. 1628–1658) was an able general and a great patron of the arts. The kingdom of Ahmadnagar was finally annexed to the Mughul Empire during his reign, and Bijapur and Golconda, the last of the five states into which the old Bahmani kingdom had been divided, acknowledged Mughul suzerainty. Shah Jahan's reign, which is usually regarded as the golden period of Mughul rule in India, is memorable for its magnificence. Besides the famous Taj Mahal (Tāj Mahall) and the Moti Masjid (Pearl Mosque) at Agra, the emperor decorated his new capital at Delhi (named after him Shah-

jahanabad) with the Red Fort, which contained the celebrated Diwān-i-ʿĀm, the Diwān-i-Khāss, and the Peacock Throne. The last days of the reign of Shah Jahan were embittered by a struggle among his four sons for succession to the throne. The third son, Aurangzeb, after defeating his brothers, confined the old emperor in the fort of Agra and ascended the throne in 1658. Shah Jahan died a captive eight years later.

Aurangzeb (r. 1658–1707) was a good general and an able ruler, but his bigotry and suspicious nature ruined the empire. Since he did not trust anyone, he never secured the confidence or goodwill of others. Reversing Akbar's policy of toleration, he reimposed the *jizyah* on the Hindus, destroyed their temples and idols, dismissed them from public service, and discriminated against them in trade and other matters. These measures alienated the Rajputs, with whom Aurangzeb was forced to wage a long and bitter war. Meanwhile, a new power developed in the south under Shivaji (Śivājī), who presented himself as the champion of Hinduism against Islam and brought into being a new nation, that of the Marathas. Aurangzeb made a strenuous effort to crush Shivaji, but despite initial successes he failed in the end. In 1674, Shivaji succeeded in founding an independent Hindu kingdom in Maharashtra.

Shivaji died in 1680, and almost immediately thereafter Aurangzeb concluded a treaty with the Rajput ruler of Mewar and proceeded to the Deccan to consolidate Mughul supremacy there. He remained in the Deccan for nearly 26 years. During this period he finally conquered Bijapur and Golconda and advanced (1690) as far as Tanjore and Trichinopoly (now Tiruchirappalli). Although the Mughul Empire thus reached its greatest extent under Aurangzeb, he failed to destroy Maratha power. He conquered the Maratha forts one after another, and the enemy seemingly disappeared, but as soon as he left an area the Marathas recaptured the forts, harassed the Mughul army by guerrilla tactics, and even pillaged the imperial camp. Aurangzeb faced a national rising which his undoubted military talents and the vast resources of the empire could not subdue. At last, wearied by the hopeless task, the old emperor returned to Ahmadnagar, where he died in 1707. His protracted wars in the Deccan and the tactics of the Marathas had exhausted the imperial treasury and demoralized the Mughul army and nobility; his long absence in the south far from his capital had disorganized the administration of the empire; and the destruction of Bijapur and Golconda had facilitated the growth of the Maratha Empire. While Aurangzeb seemingly left the Mughul Empire at the height of its power, in reality he brought it to ruin.

See also 7. *Architecture and Art* and 11. *Literature—Classical Literature*; also separate articles on the major dynasties and rulers.

R. C. MAJUMDAR,
General Editor, "The History and Culture of the Indian People."

18. HISTORY: 1707–1947

The 240 years between the death of the last great Mughul (Mogul) emperor, Aurangzeb (r. 1658–1707), and the inauguration of independent governments in India and Pakistan saw the European intrusion into the Indian subcontinent culminate in complete foreign conquest and then give way to a reassertion of power by Indian leaders determined to shape their countrymen's

own destiny. These years may be conveniently divided into three periods. In the first, 1707–1815, European commercial penetration was supplemented by a military struggle between the British and French (assisted by their Indian allies) which left Britain unchallenged as mistress of India; in the second, 1815–1885, Britain built its Indian Empire; in the third, 1885–1947, a nationalist movement developed to whose leaders British power was finally surrendered, but not until many changes had been made in the Victorian bureaucratic regime and all efforts to preserve Indian political unity had failed.

BRITISH CONQUEST (1707–1815)

European Commercial Penetration.—The progressive disintegration of Mughul central authority which characterized the early decades of the 18th century gave rise to struggles between Indian princes to which the European powers, already firmly entrenched in trading posts called factories, could not be indifferent. Doubtless, increased European commercial activity tending to turn the more important factories into fortified enclaves outside Indian control played its part in weakening the Mughul Empire. Nevertheless, the directors of East India trading enterprises in Europe did not embark willingly and deliberately upon the course of embroilment in Indian disputes from which the building of a British empire in India was to follow. Their chief concern was trade, at this period the purchase of India goods—that is, chiefly cotton and silk hand-woven cloth, raw silk, pepper, salt-peter, and sundry drugs—with the proceeds of cargoes of silver, base metals, and woollens exported from Europe. They hardly realized the extent to which, in developing their trading organizations, they had laid the foundation for the subjection of vast regions of Asia to European control. These were no ordinary commercial enterprises: they had most of the attributes of governments, though possessing influence and wealth rather than territory. Indeed, the oldest of them, which in the course of the 16th century had set the pattern for all the rest, was and remained a government, for the Portuguese crown never granted monopoly rights in East India trading to a company of its subjects but managed the business itself, sending out its trading fleets, manning its commercial outposts with its servants and their Eurasian progeny, defending them with Eurasian and other mercenaries, and making the Portuguese language the *lingua franca* of the whole East from the Cape of Good Hope to Canton.

The Dutch, English, French, and Danes, who conducted their East India trading through companies chartered by their respective governments, followed the Portuguese pattern and perfected it. By the early 18th century nearly the whole littoral of southern Asia and its adjacent islands from the Arabian to the China seas was dotted with European trading factories of one kind or another—at one port, as at Mocha, these were floating factories, the ships of the East India companies lying offshore at the coffee-selling season; at another, as at Bombay, a whole island with a magnificent harbor was held in full European sovereignty, a haven of peace and security to which any Asian trader could bring his capital and skill; or, as at Surat, the European companies maintained factories side by side under agreements with the local authorities.

In all these factories lived tiny groups of Europeans, all but submerged by the teeming Asian life around them, six months from home by sea, preoccupied by their struggles with Asia's "corrupting sun" and their hopes of surviving to return with a respectable fortune. In their employers' eyes their primary business was writing—that is, compiling the ledgers and drafting the correspondence always in duplicate and often in the triplicate and quadruplicate which distance from Amsterdam, London, Paris, Copenhagen, and Lisbon entailed. They would not have been at their posts at all, however, had they not been permitted to trade *within* Asia on their own account. In the profits of such trade lay their main hope of achieving financial independence.

In his private capacity an enterprising and ambitious servant of a European East India company like the American-born Elihu Yale, governor of Madras from 1687 to 1692, had his own commercial establishment with his own ledgers and letter books recording his own commercial ventures in the Indian seas, his own Eurasian or Indian clerks, and often a "country ship" or two of his own manned by lascar crews under European captains and mates of his own choosing. In his public capacity, whether a governor of a great factory and fortress like Madras or a young factor or writer on his way up the ladder of preferment, such a man was serving a large and often complex trading organization with its headquarters in Europe. At this period the greater of these East India companies, the Dutch and the English, administered large fleets both outward and homeward bound in each annual trading season, managed resources equal to those of many an Asian prince, coined money both on their own behalf and on that of others, carried on a vast correspondence within Asia as well as to and from Europe by land as well as by sea, and conducted diplomatic negotiations with local political authorities almost entirely on their own responsibility. As piracy was rife throughout the Indian and China seas, all European East India company ships were armed, and very well armed with guns served by expert gunners. This was equally true of all sizable country trading ships, and many of the stronger and more important European trading factories were defended by forts garrisoned by small bodies of troops under European command. There was thus available in southern Asia, and especially on the periphery of the Indian subcontinent and the Indonesian archipelago, a reservoir of European power of a depth and extent largely unrealized because it was unobtrusive and widely dispersed, ever present at sea but hardly visible on land.

In India it was not without significance that the European powers which held almost entirely aloof from Indian disputes were the smaller trading nations—Portugal, the Netherlands, and Denmark. Britain and France were unable to do so primarily because of their involvement in wars with each other over European and American issues. The conditions under which Europeans lived and traded in 18th century India also helped to make it impossible for the subjects of the two foremost European powers to forget national rivalries in the pursuit of individual gain.

Anglo-French Conflict.—However much the directors of the British and French East India companies might wish to neutralize their shipping and their Indian factories from the consequences of war in Europe or in North America, they were

defeated by the impossibility of confining the arena of Anglo-French naval conflict to the Atlantic and by the extensive opportunities open to their servants in India for the acquisition not only of wealth but of power. In the early 1740's the materials for empire building were already at hand. Internecine strife was clearly apparent in southeast India and latent elsewhere. Each contestant for Mughul administrative office or local lordship was eager to acquire European military skill and weapons in exchange for cash, credit, or grants of land. A few Europeans were aware of the possibilities of fashioning armies of European-officered Indian mercenary sepoys and Eurasian artillerymen. More Europeans were anxious to supplement profits from country trading within the Indian seas with profits from military and political activity. The arrival in India of the news that France and Britain, since 1741 *de facto* combatants in the War of the Austrian Succession on behalf of their respective allies, had at last officially declared war upon each other (March 1744) was but a spark to this tinder. Thenceforth, European initiative, enterprise, and greed, armed with powerful European weapons and assisted by Indian disunity and treachery, completed the destruction of the Mughul Empire and laid the foundations of British ascendancy.

The first theater of Anglo-French conflict in India lay in the southeast. Here, in a bewildering series of intrigues, the men on the spot supported their respective candidates for the subahship of the Deccan and the nawabship of the Carnatic. In the first phase the honors were distinctly with the French, not only because of Comte Bertrand François Mahé de La Bourdonnais' capture of Madras (1746), which the diplomats restored to Britain in 1748 at the Treaty of Aix-la-Chapelle, but because of the skill of Marquis Joseph François Dupleix (governor general, 1742–1754) in buttressing his Indian allies' position and initiating in the Deccan the system of a French-officered subsidiary force paid with the revenues of lands especially assigned for the purpose. However, with young Robert Clive's renowned exploit in storming and holding Arcot (Aug. 31–Nov. 15, 1751) to relieve the pressure on the British-sponsored candidate for the nawabship in Trichinopoly (now Tiruchirappalli), the tide began to turn against the French. Dupleix' dismissal (1754) by a government stung by serious military reverses, and under pressure from directors who had never approved Dupleix' policy, may be said to presage French failure in India. Nevertheless, to contemporaries the French in India appeared for many years afterward to have the advantage of the British in military skill and in the arts of Indian diplomacy.

Far more significant for the future were the events which took place in Bengal upon the death of its nawab, Ali Vardi Khan, in April 1756. His young and dissolute successor, Siraj-ud-Daula, perhaps prompted by a desire to prevent the Europeans from behaving in Bengal as they had in the south, rashly drove the British out of Calcutta and thus brought down upon himself the full force of a retaliatory expedition from Madras led by Clive. Bengal then lay exposed both to the exercise of European military skill marshaled by a "heaven-born general" and to the practice of the arts of fomenting treachery by an experienced coterie of Europeans and Indians. The recapture of Calcutta (1757), supplemented by a few months of in-

trigue, sufficed to undermine Siraj-ud-Daula's authority. Plassey, fought on June 23, 1757, was not so much a battle as the essential military climax of a carefully prepared coup d'état which ensured that future nawabs of Bengal would be mere puppets of the British. Despite its bizarre qualities as an engagement in which 2,000 sepoys and 1,000 Europeans defeated a vast Indian army honeycombed with treachery, Plassey may quite appropriately be regarded as the symbol and portent of European domination of India. The ease with which it laid open to conquest and spoliation one of the great Mughul viceroyalties invested it with glamour during the period of British rule. It came to epitomize the curiously complex web of European and Indian interests from which a new order in India was fashioned in the ensuing half century. In 1763, by the Treaty of Paris, French interests in India were reduced to Pondichéry (Pondicherry), Chandernagor (Chandernagore), and a few other small posts.

Development of British Rule.—By 1770 the outlines of the system on which British power was to rest in India began to be clearly discerned. In taking control, with the nominal consent of the almost powerless Mughul emperor at Delhi, of the revenue of Bengal, through the emperor's so-called grant of the *dewanee* (Hindi *diwānī*) in 1765, the British East India Company stood forth as a country power in its own right. Its advantages over other country powers in any contest for supremacy were three: its corporate immortality, its control of naval power, and its possession in Bombay and Madras of subsidiary bases of operation. Its disadvantages lay in its alien character and in the reluctance of its directors to sanction a policy of conquest and expansion.

For an understanding of the manner in which some hundreds of its servants were able in a few decades to secure its recognition as the most powerful of Indian princes, it is necessary to bear in mind the almost constant interaction of European and Indian events. In the London of the 1770's, the return of many a nabob with a fortune, and the prospect of avoiding the export of silver by purchasing homeward cargoes with the surplus revenue of Bengal, convinced both the government and the company that the Indian possessions were of immense and increasing benefit to the British nation. Henceforth, the company's affairs were subjected to ever-closer scrutiny and regulation by Parliament. No one doubted the chaotic and precarious state of the company's finances, but it was felt that, once the company's servants had been prevented from cheating their employer, Indian wealth would flow to Britain in an ever-broadening stream. In India the newly arrived writers, factors, and military cadets were learning of the multifarious ways in which they could become wealthy as a consequence of the company's expanding political activities. Military campaigns, whether connected with the Anglo-French wars in Europe or not, gave opportunity for collusive supply contracts of many kinds. Assumption of governmental functions of any sort usually meant that a company's servant was in a position to bestow favors—for example, exemption from customs duties—for which the Indian mercantile community was willing to pay. Profits from such transactions could be reinvested directly or indirectly in ventures of various kinds, not the least of which were ever-expanding British country trading voyages in the Far Eastern seas.

It is against this background that the wars and annexations of the years 1765–1815 should be viewed. An era of frank spoliation under Clive gave way to a period of more subtle penetration under Warren Hastings (1772–1785). Of Hastings it may be said that his difficulties arose primarily from too great familiarity with Indian institutions and ways of life. To him the company was an Indian power strengthening its influence vis-à-vis other Indian powers. By his opponents, India was seldom thought of apart from its place in British politics. Hastings infused with vigor an administrative machine still largely dependent on Indian personnel. He developed a subsidiary alliance system. Although he did not crush the power of the Muslim sultans of Mysore, Hyder (Haidar) Ali and Tipu Sahib, in the First and Second Mysore Wars, he made the company's sword respected from Delhi to Cape Comorin. Fortunately for Hastings, the American War of Independence ended before France could follow up the naval victories which Admiral Pierre André de Suffren had won for it in the Indian seas. By the time Hastings left India, the bases of British economic and political dominance were firmly laid, and all was ready for the march of British power.

A dramatic personal vendetta between Warren Hastings and Philip Francis had during the 1770's brought India more and more into the public eye in Britain. As a consequence of renewed financial embarrassments growing largely out of the American War of Independence, the affairs of the East India Company were drawn into the vortex of British politics in the early 1780's. The prospects of drastic reforms envisaged by Charles James Fox and his friends alarmed the most powerful among the India interests. After the direct intervention of King George III had caused the defeat of Fox's India bill in the House of Lords, the India interests helped greatly to consolidate William Pitt the Younger in power in 1784. Pitt's India Act, which set the pattern of Indian government from 1784 to 1858, subjected the company's political activities to control by the state but left the company's patronage and commercial activities comparatively undisturbed. After the removal in 1786 of a clause requiring an investigation into the private fortunes of company servants upon their return to England, nearly every European intimately concerned with India was satisfied. British and foreign investors in the company were sure of their dividends. Europeans who had supplied the company in India with funds acquired in devious ways were certain that their bills of exchange on London would be paid. British and foreign agents concerned with remittances from India through non-British channels were sure that if the whole edifice of British power in India did not crumble, no law of the British Parliament could completely destroy their profits. Fixed salaries, supervision by governors no longer closely identified with the company's service, and other reforms were inevitable, but India could still offer attractive opportunities to enterprising Europeans.

To effect a policy of reform and meet the growing public criticism which was soon to culminate in Edmund Burke's orations against Hastings, the Pitt ministry chose as governor general the 2d Earl (later 1st Marquess) Cornwallis, who was to redeem in India a reputation tarnished by the American disaster. Cornwallis,

during the years 1786–1793, more than justified the government's choice. Personally incorruptible, he developed in Bengal an administrative policy which resulted in the efficient professional bureaucracy of the Victorian era. From his day dates the policy of Europeanizing all but the lesser ranks of the civil service which was to prevail throughout the next century. From his day, too, dates the beginning of the transformation of the company's Madras, Bombay, and Bengal armies into something more than mere mercenary forces without any tradition or *esprit de corps*. It was, however, 30 years before the pay and conditions of service in India were such that disaffection among the company's European military officers was not to be feared, and even longer before military efficiency ceased to be impaired by ill feeling between the company's army and the king's regiments stationed in India.

Lord Cornwallis' most lasting achievement, and the one which in the Indian mind has overshadowed all his efforts at reform, was the celebrated permanent revenue settlement in Bengal (1793). This arrangement, with which his name is always associated, though others in both India and Britain bore much of the responsibility for it, had the effect of making the Bengal zamindars (Hindi *zamindār*) not only landlords of the soil in the European sense, but landlords obligated to pay the government a fixed rent which could not be altered under the vastly changed circumstances of the next century. Through the operation of forced sales of the lands of those zamindars whose revenue payments fell into arrears, a new class of zamindars arose largely devoid of the traditional paternal interest in the welfare of their tenants and eager to profit over the years from the increased value of lands on which the revenue charge remained fixed.

Though a faithful adherent of the policy of no aggrandizement enjoined by both company and government, Cornwallis was drawn, largely through the complex machinations of European merchants and company servants, into a full-scale conflict with Tipu, sultan of Mysore (Third Mysore War, 1789–1792). In this contest, Cornwallis had the support of the two other strong country powers—the Marathas and the nizams of Hyderabad. Even after this war, which deprived Tipu of an immense treasure and half of his territory, there was some prospect that the company might be able to forego further territorial expansion. Many of the men most influential in directing policy sincerely wished the company to remain *primus inter pares*, holding the balance among the important country powers and acting, whenever necessary, in the name of a subservient and completely cowed Mughul emperor. The French Revolution, however, extinguished such hopes. Napoleon's Egyptian expedition of 1798 thrust India into the arena of world politics. In the person of the 1st Marquess Wellesley, governor general from 1798 to 1805, there came out to India a great proconsul who turned the company's ally, Nizam Ali, into a feudatory (1798); destroyed Tipu (Fourth Mysore War, 1799); took the first and most decisive steps in the conquest of the great Maratha chieftains; and paid no attention to the company's concern over its ever-mounting Indian rupee debt.

Meanwhile, British mercantile interests outside London, newly strengthened by the then imperfectly perceived consequences of the Indus-

trial Revolution, were preparing for the final attack on the company's monopoly of the India trade. Although the true economic benefits to the British nation from the increasingly complex process of empire building in India at this period were in all probability of quite modest proportions, few contemporary Europeans doubted that they were enormous. Few of the merchants who so ably marshaled their influence in Parliament to open the trade with India to all British subjects in 1813 realized that the trade thus opened would soon differ profoundly from the India trade carried round the Cape of Good Hope since the days of Vasco da Gama. Nor did they realize that the new trade in which export of machine-made textiles and other consumer goods was to be the dominant element would provide a far firmer base for empire than the old. Thus, as the company was ceasing to be a merchant in India and was concentrating its energies on the administration of its growing raj (Hindi *rāj*), the machine had already begun the work of reducing India's old handicraft industries to a shadow of their former selves. India, for centuries a workshop for Europe, was about to fall completely under the domination of the new workshop of the world. Nowhere was the peace of 1815 more of a *Pax Britannica* than in the lands bordering the Indian Ocean.

BRITISH RAJ (1815–1885)

Political and Military Developments.—In considering the process by which the great bureaucratic Victorian Indian Empire was built, it is perhaps well to summarize the political and military history apart from other aspects of the story. After 1815 there was no turning back. As governor general succeeded governor general, the British color crept over the map—extinction of Maratha power under the 1st marquess of Hastings (1813–1822) by 1818; conquest of Assam, Arakan, and Tenasserim (First Burmese War, 1824–1826), under Earl Amherst of Arakan (1823–1828); annexation of Coorg and strict control over many renowned and ancient Rajput houses under Lord William Cavendish Bentinck (1828–1835). With British power unchallenged from the Bay of Bengal to the eastern edge of the Indus Basin, it was only natural that the prospect of Russian expansion to the confines of India should begin to agitate more and more British minds.

In 1838 there were inaugurated profitless and unhappy policies which, in aiming to secure Afghanistan from Russian penetration, brought in their train defeats, military and diplomatic, which helped prepare the way for the Indian Mutiny of 1857. In brief, without sufficient attention to the slender potentialities of Russian policy or power in this region, without constant and unrelenting adaptation to the ever-changing military situation among Pathan tribesmen and along the Perso-Afghan frontier, an attempt was made in the First Afghan War (1838–1842) to thrust British power beyond the Indus in support of Shah Shuja (r. 1803–1810; d. 1842), an unpopular Afghan chieftain. The war was, moreover, undertaken before the Sikh power in the Punjab was itself subdued (1845–1849), such was the measure of British confidence in the invincibility of the Anglo-Indian military machine under the administration of George Eden, earl of Auckland (1836–1842). There ensued the utter military defeat of 1842, when a faithful pony

brought into Jalalabad the exhausted Dr. William Brydon as the sole survivor of an army of more than 4,000 troops and 12,000 camp followers which had sought safety by retreating through the passes from Kabul.

Although the conquest of Sind (1842–1843) and that of the Punjab (1845–1849) were in a sense byproducts of Afghan disaster, neither these operations nor the marching of armies back and forth in southern Afghanistan could obliterate the consequences of the ill-starred First Afghan War. The spell of British invincibility was broken. Afghanistan was evacuated. The raj had lost face at a time when the Indian masses were becoming dimly conscious of the impact of such new forces as the nonofficial European merchant and plantation owner, the Christian missionary, the steamship, the telegraph, and the railway. Moreover, James Ramsay, 1st marquess of Dalhousie (1848–1856), a young and masterful administrator, pressed on in the 1850's with a policy of annexing the territories of Indian princes who were either without heirs or peculiarly impervious to admonitions of reform from the company's government. This policy culminated in 1856 in the annexation of Oudh, perhaps the worst governed of the premier states, but the one from whose domains most of the sepoys in the Bengal Army were recruited.

Upon Lord Dalhousie's successor, Earl Canning (1856–1862), the storm burst on May 10, 1857. Vexed as the problems of the origins of the Indian Mutiny are, there is no question but that the decisive factor was the widespread belief that the cartridges issued with the new Enfield rifles were greased with animal fats abhorrent to both Muslims and Hindus. Careful study of the first weeks of the mutiny shows no widespread conspiracy, concerted planning, or well-thought-out objectives. This does not mean, however, that various native princes and influential landlords did not join the movement for political motives or that it did not evoke vague stirrings of national consciousness among some of those chiefly concerned. Later investigations have shown that those who assumed positions of leadership organized an administration for the territories they briefly controlled with considerable efficiency and skill. Nevertheless, what took place was primarily a military revolt of one of the company's three armies. The Bombay and Madras armies were unaffected, as was most of the subcontinent outside the regions near Delhi in which the fighting took place.

The mutiny was suppressed with great severity in 1857–1858. The heroic, moving tales of the blowing up of the Delhi magazine, of the siege of Cawnpore (now Kanpur), and of the relief of Lucknow, on which Rudyard Kipling's generation was reared, form only the more colorful side of the story. The mutiny left a legacy of bitterness which persisted for at least a generation, but, even more important, wherever it may not have fostered hatred, it fostered the type of aloofness in the ruling race which the increasing number of Western-educated Indians most resented. In government the mutiny caused the dissolution of the East India Company and brought British efforts to modernize and reform the great Indian princely states to an abrupt and unnatural halt. The Government of India Act of 1858 transferred all the East India Company's authority to the crown, and provided for the administration of India through a secretary of

state for India in the British cabinet.

With British dominance throughout the subcontinent assured after the suppression of the mutiny, the officials concerned with India's foreign policy became more preoccupied with the problem of the northwest frontier. Here the persuasiveness of the forward school and the belligerent imperialism of Benjamin Disraeli combined to produce a Second Afghan War (1878–1880) almost as inglorious as the first. The 1st earl of Lytton (viceroy, 1876–1880), unable to readjust his Afghan policy quickly to Disraeli's diplomatic triumph over Russia at the Congress of Berlin, became involved in a war which did little to pacify the frontier, greatly increased the Indian debt, and left on the Afghan throne in Abdur Rahman Khan (r. 1880–1901) a chief who had every reason to prefer Russian to English influence.

Social and Economic Developments.—In Lord Lytton's day the men who staffed the great bureaucracy which had been built up during the two previous generations were of a somewhat different stamp from those who had served Lord Hastings. In 1815 the company's patronage system was still vigorous, and a young man's hopes of an Indian career depended on his connections. In the next 60 years there occurred a gradual extension of the Indian services beyond the coterie of families connected with East India interests in the 18th century. Among such families varying social backgrounds had been represented—chiefly London merchant and shipping families, lesser country gentry, and younger sons of Scottish nonnoble houses—but by the early 19th century all were characterized by close association with India and Indians. Furloughs in those days were infrequent, keeping a European wife and children in India was a hazardous venture, and it was difficult to cut oneself off from Indian life. By 1880 all this was profoundly changed. The introduction of competitive examinations for the Indian services in 1853 tended to confine them to the best brains of the English university world, a world which can hardly be described as other than socially select. Improvements in communications and sanitation made it possible for nearly all British officials to keep British wives and children in India. Inevitably the European station with its club grew up beside the military cantonment, its life divorced from the surrounding Indian world.

Improvement in communications led to the perfection of the bureaucracy. The most remote post office came into immediate contact with headquarters. A subordinate army of Indian clerks and messengers was available to copy and move the mountains of official papers which made the wheels of government revolve. At the top stood the viceroy, struggling desperately not to be buried under the ponderous files, and unquestionably the most hard-worked official in her majesty's dominions. Disraeli's action in 1876 in making Queen Victoria empress of India was criticized as out of keeping with British tradition, but it effectively symbolized the transformation which had taken place in Indian government since the days when the East India Company had a personality of its own.

In 1833 began the social and educational changes which were to lead to the first meeting of an Indian National Congress in 1885. This was the time when the effects of the Reform Bill of 1832 and the reform and free trade move-

ments in Britain began to be felt in India. The company lost its monopoly of the China trade and became merely a vehicle for governing India, dominated largely by men who had served in India. The home government, however, was controlled by Whig politicians immersed in the Reform Bill struggle who had little experience of India. It was hardly extraordinary that they should stand for an ever-wider extension of Christian missionary enterprise and the introduction of an educational policy favoring the teaching of English and the dissemination of European rather than Oriental learning. Missionary policy had long been settled on the understanding that the government would continue its policy of neutrality with respect to all religions. Active controversy in the early 1830's concerned educational policy.¹ The older generation of company servants, who knew something of the values of Indian learning both ancient and modern, were no match for the brilliant Thomas Babington Macaulay, future historian of the English Revolution of 1688. Macaulay, who came out to make his fortune as the new law member of the governor general's council in 1834, wrote in February 1835 the famous minute which was decisive in determining the English character of higher education in India.

With respect to elementary education, decisive action was not taken until 1854, when the dispatch of Sir Charles Wood (later 1st Viscount Halifax) declared that both English and vernacular languages should be used in diffusing European knowledge. The officials who drafted this dispatch, realizing the impossibility of securing enough persons qualified to teach English in the elementary schools, were inaugurating a policy of extensive government support to vernacular education for the masses. There had thus evolved by the postmutiny period the educational policy which was to become typical of modern India: stress on European learning, instruction in the vernacular at the elementary level, higher education on a British model, government grants-in-aid to all properly managed schools willing to accept government inspection, and equal treatment of each school accepting the conditions, irrespective of communal or other affiliations.

At the apex of this educational system stood the three universities of Calcutta, Bombay, and Madras, founded in 1857, which turned out year by year an ever-increasing stream of young men to swell the numbers of the small English-knowing, Westernized middle class. Under the circumstances of the time most of these graduates aspired to become lawyers or government servants. Though chiefly influenced by their reading of English history and literature, they were far from immune to the currents of change which were sweeping in upon their own cultural heritage, whether Hindu or Muslim. Already for a generation orthodox Hinduism had been under attack from reformers who wished to purge it of those practices and customs most objectionable to Europeans. It was therefore quite natural that these new ideas should appeal to large numbers among the newly educated middle class, and equally natural that, in contrast, a small group among these new graduates should react in exactly the opposite manner. Such young men, having read not only their own literature but the works of European scholars on the ancient Hindu past, were moved to protect their heritage against what

they regarded as undesirable innovations. There thus appeared among those Hindus from whom the supporters of nationalist movements were to come two schools of thought—the one certain that India's only wise course lay in the full and unquestioning adoption of the ideas and political institutions of its rulers, the other rejecting most of what the West had to offer and seeking India's new golden age in its ancient past.

Among Muslims the effects of the new university education were markedly different. Far fewer of them took advantage of its opportunities—a circumstance greatly regretted by their descendants when the days of freedom for India were fast approaching. Not only did the mutiny throw their whole community under a cloud for several years, but their cultural leadership lay primarily with religious leaders fanatically devoted to the traditional Islamic Arabic and Persian learning. When a lay leader did appear in the person of Sir Sayyid Ahmad Khan in the 1870's and 1880's, he felt that the only wise political course for Muslims was complete loyalty to British rule and wholehearted and unquestioning acceptance of Western political ideas, to be taught in a university of their own—Aligarh Muslim University, which he founded in 1875 as an "Anglo-Arabic" college.

By 1885 civil and military government servants, businessmen, missionaries, and schoolmasters had built in India an empire very different from that over which the East India Company had presided. In 1815 the company's domain was still a country power, pre-eminent among country powers, and ruled by men whose outlook was often as much Indian as British. Most of these men believed in a policy of noninterference with Indian life and society and in limiting India's contacts with Europe to those arising from the commercial and administrative activities which ensured their own well-being. In 1885, India had become the greatest modern colony, a vast domain ruled by a *corps d'élite* sent out for that purpose by an alien European power.

INDIAN NATIONAL DEVELOPMENT (1885–1947)

Although one or more Indian nationalist bodies met annually from 1885, the general history of India and the histories of Indian nationalist movements were not closely intertwined until after World War I. The Victorian bureaucratic machine moved ponderously on, hardly paying any heed to nationalist agitation except when moved to action by some overt act. Liberal-minded viceroys like George Frederick Robinson, 1st marquess of Ripon (1880–1884), were the exception, not the rule. The raj occupied itself with the perfection of antifamine programs, with army unification (1893), and with irrigation projects. British rule was assumed to be permanent. The storm raised by Lord Ripon's attempt to deprive Europeans of their privilege of being tried always before European judges (Ilbert bill; 1883) enjoined a continued policy of caution as far as indianization of the civil services was concerned. Nevertheless, indianization was begun on a modest scale, and was accepted as an inevitable goal of future policy. Before 1906, however, there was no serious consideration of extending self-government beyond very modest dimensions.

In the 1st Baron (later Marquess) Curzon of Kedleston (1899–1905), India received a proconsul of Wellesleyan stature exactly a century after

Wellesley. Though not a century behind the times, Curzon was peculiarly blind to Indian sensibilities. His partition of Bengal into two provinces, made in the interests of bureaucratic efficiency, exasperated the rapidly increasing number of politically conscious Indians both within and outside Bengal. This action was perhaps the most important single factor which ushered in the period when peaceful nationalist agitation was occasionally embarrassed by the commission of political crimes of various sorts. It was greatly to the credit of the philosophic Liberal, John Morley (later Viscount Morley of Blackburn), who became secretary of state for India in 1905, that he did not allow himself to be diverted by sporadic acts of violence from his plans for drastic Indian political reform.

Morley-Minto Reforms.—Lord Curzon's departure, hastened by his dispute with Viscount (later 1st Earl) Kitchener of Khartoum over the latter's proper functions as commander in chief in India (1902–1909), prepared the way for the first major step toward Indian self-government. The Morley-Minto reforms (Indian Councils Act) of 1909 introduced the elective principle for some seats in the governor general's Legislative Council and greatly increased the elective element in the provincial legislative councils. All this, however, was done on a basis of representing various communities, chambers of commerce, and other similar groups. In accordance with this principle, Muslims, who had sent a special deputation, led by Aga Khan III, to the viceroy, Gilbert John Elliot-Murray-Kynynmound, 4th earl of Minto (1905–1910), in 1906, received separate representation. This granting of separate electorates to minorities, though later vehemently criticized by Indian nationalists, was quite in keeping with the most advanced and liberal British thought of the day with respect to broadening the base of Indian government. Nearly every Briton who studied the subject intimately at that time held that the British parliamentary system was entirely unsuited to Indian conditions. Not only was anything like universal suffrage for India regarded as unthinkable, but everyone assumed that the problem was to give the intellectuals and the propertied and influential segments of Indian communities a feeling that they had a share in the government of their country.

Consequently, by 1910 the autocratic nature of Indian government was hardly changed at all. The Morley-Minto reforms, however, did have the effect of causing many of the intellectual moderates prominent in nationalist bodies to feel that they had not labored in vain. Psychologically, the appointment of one distinguished Indian to the governor general's Executive Council, coupled with the association of many others in the high administrative and legislative spheres, marked a sharp break with the Victorian past. For this the Indian National Congress was largely responsible. It had met annually since 1885, when Allan Octavian Hume, a retired civil servant, and a few of his friends assembled about 100 people in Bombay with the benevolent acquiescence of the government. Year by year the organization had grown. Europeans, Parsis, and Muslims were prominent in it from its earliest years, but inevitably the majority of its members were Hindus, among whom lawyers from Calcutta and Bombay predominated. Its continued existence and the success it achieved in bringing pressure to bear upon the government caused

Muslim religious leaders and landlords to realize how far the Muslim community had lagged behind the Hindu in producing an English-educated minority eligible for high government posts. The Muslim League was therefore formed in 1906.

The success of the great imperial durbar (Hindi *darbār*) of 1911, when the capital was moved to Delhi and the partition of Bengal was reversed, on the occasion of the coronation of King George V, was in itself a testimony to the strength of the British raj. All that nascent nationalism had accomplished was to associate with durbar government a handful of distinguished Indians, most of whom were out of sympathy with the National Congress. In Gopal Krishna Gokhale and Bal Gangadhar Tilak, Indian nationalism had produced its first great figures, the one a moderate, the other an extremist who was thought of as the inspiration of the increasing number of political assassinations. In 1913, however, the raj seemed more stable than ever and would doubtless have been capable of resisting change for many years had it not been for World War I.

World War I and Postwar Reforms.—World War I profoundly disturbed the placid currents of Indian political and administrative life. Not only did Indian troops fight in France and the Middle East, but the best of the British civil and military administrators were drawn away from India. Nationalists had a practical demonstration of the ability of Indian government to function without the accustomed quota of British personnel. When it appeared toward the end of the war that British officialdom was intent on returning to the old order of things, great resentment and frustration spread over India. Racial bitterness reached a climax with the Amritsar massacre of 1919, when Brig. Gen. Reginald Dyer ordered troops to fire on an unarmed mass meeting in an enclosure with only one very narrow exit. Nearly all politically conscious Indians felt that India's great efforts in the war had been betrayed, and that the Montagu-Chelmsford reforms (named for Edwin S. Montagu, secretary of state for India, and Frederic Thesiger, 3d Baron Chelmsford, viceroy from 1916 to 1921), then being framed into the Government of India Act (1919), were very inadequate as an implementation of the solemn British wartime promise (Aug. 20, 1917) of "... the gradual development of self-governing institutions with a view to the progressive realization of responsible government in India as an integral part of the British Empire. . . ."

Nevertheless, the Montagu-Chelmsford reforms of 1919 definitely broke with the idea that India must follow some other path than that leading toward parliamentary self-government. The reasons for this change are complex, but it was a natural consequence of the attainment of a separate international position by the British self-governing Dominions during the war and at the peace conference. India, despite its juridically dependent status, could hardly be denied many of the privileges accorded to the Dominions, notably the privilege of signing the peace treaty separately and of becoming in its own right a separate member of the League of Nations. It was also accorded much more independence in fiscal policy than had been customary before the war. Moreover, the phrase "responsible government" used in the declaration of 1917 was, in view of its history in the Dominions, generally interpreted as meaning responsible cabinet government of the

British parliamentary type.

The Montagu-Chelmsford reforms set the pattern which was to determine the actual administration of India from 1919 until the eve of independence. The central government at New Delhi underwent almost no change between 1919 and 1946; the system by which the British crown's paramountcy over Indian princely states was exercised changed slightly in form but not in substance. In the provinces there was change: full autonomy on April 1, 1937 (when the Government of India Act of 1935 went into effect) replaced the partial autonomy granted in 1919, but World War II supervened so quickly that full provincial autonomy was to a large extent stillborn. In brief, what the Montagu-Chelmsford reforms did at the center was to set up a bicameral legislature—the upper house (Council of State) chosen by an electorate of approximately 80,000 and the lower (Legislative Assembly) by an electorate of approximately 1 million (registration, about 5 million). Nominated members were still an important element in both houses; in choosing elected members communal electorates were used extensively. Legally, the executive remained authoritarian and bureaucratic, not responsible to the legislature and buttressed by extensive emergency powers. Practically, the central legislature was a fairly effective forum for the ventilation of grievances, accomplished much useful work, and, paradoxically, despite its powerlessness attracted some of the ablest Indian politicians, especially at times when nationalists were not boycotting the government and refusing to take their seats. In the provinces the reforms introduced dyarchy—that is, the turning over of certain departments, such as those dealing with education and other “safe” subjects, to Indian ministers responsible to majorities in the lower houses of the provincial legislatures. Naturally, the system did not work well. The Government of India Act of 1935 granted full provincial autonomy and expanded the provincial electorates to cover approximately 33 million voters, but provincial governors retained ample emergency powers, including that of assuming full powers of administration in the event of political deadlock.

Political and Economic Developments of the Interwar Period.—Within a decade after the end of World War I serious Hindu-Muslim differences in the nationalist movement began to appear. Among the causes for the disappearance of the earlier atmosphere of harmony, dating back to 1916 when the Congress had reluctantly acquiesced in the existence of Muslim electorates, must be listed the new revolutionary fervor imparted to the Congress movement by Mohandas K. Gandhi; the fiasco of the caliphate agitation (protest by Indian Muslims against the Treaty of Sèvres) of 1920–1922; Mohammed Ali Jinnah's emergence to leadership among the Muslims in contrast to Gandhi as leader in the Congress; and increasing fear among Muslims of Hindu domination of any centralized parliamentary government. In his philosophical nonviolence, Gandhi developed a technique difficult for Muslims to understand, and he further baffled Muslim nationalists by calling off a civil disobedience movement, because of outbreaks of violence (at Chauri Chaura), in 1922 when it seemed to be succeeding. At the time of the caliphate agitation, Mustafa Kemal (later Kemal Atatürk), by setting up a nonreligious Turkish state, and the Moplas (Malayalam *Mappila*, Muslim peasants of Malabar),

by killing Hindus in southern India, greatly embarrassed the Muslims and Hindus who were attempting to mitigate the terms of the Treaty of Sèvres. As Gandhi developed the peculiar religious quality of his hold over the Indian masses, it was natural that Muslims, especially those of the more conservative and less revolutionary types, should turn to Jinnah or to other Muslim leaders.

The immediate occasion, however, of serious Hindu-Muslim rift was the Nehru report of the Indian National Congress of 1928, resulting from the challenge of British conservatives that Indians had many criticisms of the existing government but were never willing to draw up a blueprint for a new one. Under the chairmanship of Pandit Motilal Nehru, a distinguished committee drew up a constitution for India on a dominion-status basis. Since it was not a federal constitution and made no concessions to Muslim susceptibilities, Muslim opinion was alienated. An All-India Muslim Conference gathered at Delhi under the aegis of the Aga Khan. Representatives of the Muslim League, now solidly behind Jinnah, and of nearly all other Muslim organizations, proclaimed in 1929 the Muslim 14 points, which insisted on separate Muslim electorates, a federal government with residual powers in the provinces, a three-fourths majority rule in legislatures on all communal questions, and appropriate Muslim representation in both provincial and federal cabinets.

During the decade 1929–1939 the Muslim-Hindu rift steadily widened. Each of the great parties—the Congress and the Muslim League—perfected its organization under its own high command and gradually reduced to insignificance the smaller nationalist organizations, whether moderate, such as the liberals led by distinguished Indians who tried to find a compromise in a non-revolutionary program, or extremists, such as the Hindu Mahasabha, which desired a Hindu raj. Henceforth the communal question was in the forefront of all Indo-British political discussion.

British officialdom, realizing the futility of a further approach through an all-British parliamentary commission, assembled the leading Indian princes and political leaders in London in 1930–1932 for three round-table conferences after publication of the report of the Simon Commission (named for Sir John Simon, later Viscount Simon). Gandhi, who had in the spring of 1930 dramatized the Congress struggle by a no-rent campaign and by a march to the sea against the government salt monopoly, was persuaded to make an appearance at the second conference. Nothing, however, could break the communal deadlock. Prime Minister Ramsay MacDonald found himself compelled, much against his will, to authorize a British communal award, allocating seats to the different Indian communities in the legislatures of the proposed new federal Indian constitution.

Six years of discussion (1929–1935) at last produced in the Government of India Act of 1935 a new Indian constitution. Nothing, however, could get the federation, so laboriously worked out on paper, into being. The princes, at first willing to accede to the federation, shied off in such numbers that the federal part of the act remained a dead letter. The Congress Party, which had always inveighed against the scheme as being too heavily weighted in the princes' favor, was not loath to see it die. The Muslim League, with its

fears of a Hindu raj, was also not displeased with the result. Thenceforth, the political struggle shifted to the provinces, where, under the act, full autonomy was to be tested for the first time. Following much searching of heart, the Congress Party decided upon a policy of accepting office in the provinces after receiving assurance that the governors' special powers would not be frequently or unreasonably used.

Soon after the act of 1935 went into effect (April 1, 1937), Congress ministries took office in 7 of the 11 provinces of British India, all of them Hindu-majority provinces except the North-West Frontier Province, where Khan Abdul Gaffar Khan, the Frontier Gandhi, and other Congress Muslims had built up a strong following. (Later a Congress ministry also took office in Assam.) During the ensuing two prewar years, the Muslim League accused the Congress of establishing Hindu tyrannies in the six Hindu-majority provinces (Madras, Bombay, United Provinces, Bihar, Orissa, Central Provinces) which denied Muslims their legitimate rights, especially in educational and cultural matters, and precluded the possibility of their ever wielding any political influence in these provinces. On its side, the Congress Party insisted that it did endeavor to give Muslim interests their due weight and that the Muslim League distorted every Muslim grievance for propaganda purposes.

The ministers of these new provincial governments were the leading personalities in a Westernized middle class of landlords, merchants, and lawyers far more prosperous, numerous, and sure of themselves than had been their predecessors of the previous generation. The two decades since 1918 had been characterized by great economic progress. Large-scale irrigation projects, especially in the Punjab, had been successfully pushed forward. Famine control had been developed to the point where major disasters were regarded as entirely preventable. The Indian Medical Service had much increased its efficiency in combating plague and other tropical diseases. Centers of agricultural research like the government-operated one at Pusa in Bihar and the famous American missionary one founded by Sam Higginbottom at Allahabad had improved cattle breeds and milk production.

Although the industrial labor force was only a tiny minority among a vast peasant population living close to the margin of subsistence, the development of large-scale industry in textiles and steel brought wealth to families such as the Birlas at Calcutta and the Tatas at Jamshedpur. Much of this wealth was at the disposal of nationalist leaders, thus giving the nationalist movement an economic strength which it had not possessed in the 1920's. Indian fiscal autonomy, conceded after the Treaty of Versailles, had given India considerable power to protect its own industry, and its cheap labor costs had stimulated to some extent its exports to other parts of Asia. Preoccupation of most middle-class and propertied Indians with the struggle against their foreign rulers muted possible antagonism among themselves on class and economic issues, leaving Hindu-Muslim antagonism the one great threat to national unity.

World War II.—World War II thus found the two great Indian communities more deeply divided than ever. The Congress Party proclaimed itself a noncommunal organization striving to achieve India's freedom through nonviolent revo-

lution. The Muslim League frankly professed its communalism and sought support as the protector of 94 million Indian Muslims (1941 census) against the prospect of Hindu domination. Such was the situation when the Congress Party leaders ordered all the Congress ministries out of office in October 1939 on the ground that they could not participate in an imperialist war thrust upon India without its consent. This course naturally had the effect of placing the Muslim League in a stronger position than the Congress during the war. When much of Indian political life was necessarily suspended, whether or not wartime emergency measures were in force, Jinnah and other Muslim leaders were out of jail and free to develop for propaganda purposes the plan for a separate Muslim state called Pakistan, first suggested in 1933 by some Muslim students at Cambridge University. In 1940 the League adopted its famous resolution that "the areas in which the Muslims are numerically in a majority, as in the northwestern and eastern zones of India, should be grouped to constitute independent states in which the constituent units shall be autonomous and sovereign."

In March 1942, at a very dark period of the war, Prime Minister Winston Churchill's coalition government sent Sir Stafford Cripps to India with an offer which has since been the occasion of much controversy. Its main purpose was to gain the cooperation of both the Congress and the League with the existing government by transferring to Indians on a *de facto* basis all power save that of the command of military operations and by emphasizing dominion status with consequent option of secession from the British Commonwealth as the immediate postwar British program. Negotiations broke down mainly as a consequence of the difficulties inherent in the plan for ensuring effective British control of military operations. In the postwar part of the offer, however, the prospect of partition was hinted at in the provisions whereby dissatisfied provinces could stay out of the proposed union and form a union of their own on a dominion-status basis. The Congress Party therefore publicly condemned the offer for too great indulgence toward the Pakistan idea, while the Muslim League condemned it for precisely the contrary reason.

In the Quit-India campaign which followed the rejection of the Cripps offer, Gandhi, Jawaharlal Nehru (who had long been recognized as the nationalist figure next in importance to Gandhi), and all the other Congress leaders were arrested along with several thousands of their followers in August 1942. Each side accused the other of precipitate action; the viceroy, Victor Alexander John Hope, 2d marquess of Linlithgow (1936–1943), insisted that widespread violence was planned, while Gandhi insisted that his arrest precipitated the violence. While Indian troops and resources made their contribution to victory and bureaucratic government prevailed not only in New Delhi but in most of the provinces, all political progress was at a standstill. Despite Gandhi's release on medical grounds in May 1944, the deadlock continued until, with the assurance of victory in Europe, more and more of the Congress leaders were freed in the first half of 1945. Gandhi's conversations with Jinnah in September 1944 had frustrated the hopes of those who believed that the two men could agree on some formula that would reconcile their differ-

ences on the Pakistan issue.

Independence and Partition.—While Viscount (later 1st Earl) Wavell, viceroy from 1943 to 1947, was releasing political prisoners, planning to broaden the Executive Council, and preparing for the new elections scheduled for the winter of 1945–1946, the whole scene was changed by the overwhelming victory of the Labour Party in Britain in July 1945. The election tended to remove the Indian nationalists' reluctance to believe that Britain was really determined on a full transfer of power untinged by imperialism. Within 10 months a conference attended by all political leaders was held at Simla in an unsuccessful effort to set up an interim national government (June 1945); new elections were held (November–December 1945); and a British cabinet mission came out to India to form a plan of breaking the Congress-Muslim League impasse (March 1946).

The cabinet mission's plan, announced in a white paper on May 16, 1946, endeavored to keep India united while permitting Muslim-majority provinces to group themselves together with a great deal of autonomy. It set up a feasible procedure for the election of a Constituent Assembly by the 1,585 newly chosen (January–April 1946) members of the provincial legislatures, with 93 seats to be awarded to nominees of the princely states. Moreover, it gave assurance for the first time of Britain's readiness to abandon paramountcy over all the princely states. Neither Congress nor the Muslim League felt it wise to refrain from ultimate acceptance of the plan, but before the summer was out both parties were engaged in a dispute as to various points of interpretation. In September, Lord Wavell brought matters to a head by allowing a newly appointed Executive Council to function as an interim government led by Jawaharlal Nehru. This speedily caused the Muslim League leaders to review their decision and brought about an agreement to enter the government despite non-recognition of the League's contention that it was the only body representing Indian Muslims. For a fleeting moment foreign observers thought a Hindu-Muslim accord would be reached, but it soon appeared that the government seldom if ever functioned normally. Ministers of the opposing groups seldom met face to face, and most cabinet business was done by correspondence. Moreover, the Muslim League let it be known that League members elected to the Constituent Assembly would not take their seats.

This situation remained virtually unaltered in December 1946 after Lord Wavell had succeeded in inducing Nehru and Jinnah to fly to London for conferences on the clarification of the cabinet mission's plan. When such clarification had accomplished nothing in making the interim government workable, the British government decided (February 1947) to replace Lord Wavell with Viscount (later 1st Earl) Mountbatten of Burma and to announce that Britain would withdraw from India by June 1948 in any event, transferring power preferably to one government, but not hesitating to transfer it to more than one government if such action proved unavoidable. This fateful announcement caused intense political activity behind the scenes at both London and New Delhi. On June 3, 1947, came the announcement of the plan for the partition of India into two independent dominions—India and Pakistan. The Indian princely states, no longer under Brit-

ish suzerainty, would be left free to accede to either dominion or not, as they chose. Both the Congress and the Muslim League accepted the plan.

An Indian Independence Act was passed through the British Parliament with very little debate in July, and on the appointed day, Aug. 15, 1947, the British Indian Empire ceased to exist. In its stead, after great communal disturbances in the Punjab and Bengal, which took a toll of many thousands of casualties and involved the migration of several million persons, there appeared two new nations, the one, India, covering most of peninsular India, since nearly all the princely states fell within its orbit; the other, Pakistan, with its 70 million population (1947), the most populous Muslim state in the world, composed of two disparate blocs of territory—in the northwest, Baluchistan, Sind, the North-West Frontier Province, and western Punjab up to a line drawn just east of Lahore; in the northeast, the Muslim-majority districts in eastern Bengal and the Sylhet District of Assam. Despite the continued membership of both countries in the Commonwealth of Nations, all politically conscious Indians hailed the end of the era of European rule which had so imperceptibly begun two centuries before.

See also COLONY; COMMONWEALTH OF NATIONS—*Development of the Commonwealth*; EAST INDIA COMPANIES; FRENCH INDIA; GREAT BRITAIN—21. *History*; WORLD WAR II; biographies of major figures.

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19. HISTORY SINCE 1947

Political Integration.—In August 1947, when power and paramountcy were formally relinquished by the British, the territory which is now the Republic of India was composed of a motley of 9 governor's provinces, 5 commissioner's provinces, and more than 500 princely states, and operated under a political structure conceived more than a decade earlier whose federal provisions had never been tried. One of the most remarkable achievements in postindependence Indian history was the reduction of this geographic chaos into a relatively simple administrative structure and the emergence of a strong central government to fill the gap left by the departure of the British raj.

By 1949 all the major princely states within India's purview except Hyderabad and Kashmir had been integrated with the Indian Union by means of cajolery, threats, and the provision of ample pensions for the princes. Hyderabad, a Hindu-majority state ruled by a predominantly Muslim aristocracy, attempted to establish its sovereignty as an independent country. Civil unrest within the state, including the harassment of Hindus seemingly with official encouragement, brought the dispatch of Indian troops in September 1948, in what was officially called a police action. In November 1949, the nizam of Hyderabad acceded to India, and in 1956 his domains were divided among Andhra Pradesh, Mysore, and Bombay.

The State of Jammu and Kashmir, on the other hand, was ruled by a Hindu maharaja and aristocracy, while the majority of the population was Muslim. Like Hyderabad, it postponed the question of accession. In October 1947, when it

looked as if Maharaja Hari Singh were leaning toward India, tribesmen from Pakistan's North-West Frontier Province, with Pakistani cognizance, invaded Kashmir in an attempt to capture the state government. Indian troops were quickly flown in, and open warfare broke out in the central valley west of the capital, Srinagar. Meanwhile, on October 27, the maharaja acceded to India. On Jan. 1, 1948, India brought the matter before the United Nations Security Council, hoping to label Pakistan as an aggressor under Article 35 of the United Nations Charter. The council, on April 21, passed a resolution establishing a United Nations Commission on India and Pakistan (UNCIP) that was supposed to arrange for a plebiscite. UNCIP did succeed in arranging a cease-fire on Jan. 1, 1949, and on the following July 30 the two countries ratified an agreement on a cease-fire line whereby Indian troops would occupy the Vale of Kashmir, Ladakh, and Jammu, while tribal irregulars and Pakistani troops would occupy a sparsely settled mountain district called Azad (Free) Kashmir. An elected Constituent Assembly convened in Kashmir on Oct. 31, 1951. On Nov. 19, 1956, its members approved a new constitution which contained a clause stating that no future body, whatever its character, could reverse the accession of the state to India. At Pakistan's insistence, the Security Council, on Jan. 24, 1957, passed a resolution in which it refused to recognize the permanent accession of the state and called once more for a plebiscite. Whatever the *de jure* status, however, Indian-held Kashmir was administered thereafter as an integral part of India.

The political integration of the rest of India took place in two stages. The first, leading up to the position as of Jan. 26, 1950, when the Indian Constitution was inaugurated, created a graduated federal system composed of states in varying degrees of approximation to the position of the former provinces of British India. There were (1) 9 states which until Aug. 15, 1947, had constituted in whole or in part provinces of British India, with the addition of minor princely states within their borders; (2) 8 states formed from former princely states left intact, such as Mysore and Hyderabad, and from unions of states, such as Rajasthan; (3) 10 lesser states or unions which were largely governed by chief commissioners appointed by the central government, and (4) the Andaman and Nicobar Islands in the Bay of Bengal. Meanwhile, pressure mounted to bring the reluctant government to honor a pledge, made by the Indian National Congress as early as 1922, that the administrative units would be reapportioned along lines of linguistic homogeneity. The first linguistic state, Andhra (now Andhra Pradesh), comprising the Telugu-speaking parts of Madras, was inaugurated on Oct. 1, 1953, and on Nov. 1, 1956, the rest of the states were reapportioned on similar lines. Later, in 1960, Bombay was divided into the new states of Gujarat and Maharashtra. A 16th state, Nagaland, was created in Assam in 1962. Agitation by Sikhs in the Punjab, however, did not result in the creation of a Sikh-majority state. While the French enclaves in India were ceded to India—Chander-nagor (Chandernagore) in 1951, and Karikal, Mahé, Yanaon (Yanam), and Pondichéry (Pondicherry) in 1956 (the cession was completed in 1962), Portugal refused to integrate its territories. Finally, in 1961–1962, India moved unilaterally to incorporate them—first the enclaves of Dadra and



Kulwant Roy

An honor guard of lancers drawn up before Rashtrapati Bhavan (President's House) in New Delhi.

Nagar Aveli (Nagar Haveli), and then, following a military attack, Goa, Damão (Daman), and Diu.

Domestic Problems.—Until the constitution went into effect on Jan. 26, 1950, India was governed under the machinery provided by the Government of India Act of 1935, as amended by the Indian Independence Act of 1947. A Constituent Assembly of 303 members, most of whom were elected by the provincial legislatures, sat as an interim legislature. On April 28, 1949, it was announced that India would remain within the Commonwealth of Nations as a republic, accepting the sovereign only as a symbol of the Commonwealth. Under the constitution of 1950, India emerged as a federal republic with powers divided between the central government and the states. In practice, however, the central government proved to have the more important role.

With the problems of establishing a viable government out of the way, India turned its energies to the pressing problems of economic growth. Three Five-Year plans were launched to initiate rapid economic development. The First Five-Year Plan (1951–1956) was highly successful, but the Second Five-Year Plan (1956–1961) and the Third Five-Year Plan (1961–1966) experienced greater difficulty in reaching their goals. In order to speed the pace of development the government played an increasingly dominant role in all aspects of life and, following a resolution of the Indian National Congress Party at Avadi in 1955, adopted a “socialistic pattern of society” as its objective. In practice, this meant nationalization of transportation, communications, major banks, and life insurance companies; establishment of government-owned industries in the fields of hydroelectric power, fertilizers, drugs, and steel; elaborate regulation of other sectors of the economy; sharply progressive taxation; and commitment to rural cooperatives.

In the central government and in most of the states the Congress Party, the leader of the independence movement, enjoyed continual one-party rule. In the first national elections based on universal adult suffrage, held in 1951–1952, it won 44.5 percent of the popular vote and 362 of the

489 elective seats in the House of the People. Far below it was the second largest group, consisting of the Communists and their allies, which won 27 seats and received 5.5 percent of the vote. In the contests for state legislatures the Congress Party showing was nearly as good—42 percent of the popular vote and 68.6 percent of all seats. The party had clear majorities in all except four states, and there it was the dominant partner in coalition governments. In the following years it retained its preeminent position, though not without challenge.

In the second general election, held on Feb. 24–March 14, 1957, the Congress Party retained control at the national level and in 11 states. In the state assembly elections, in which 2,899 seats were at stake, the Congress Party had 1,888 of the successful candidates, the Praja Socialists 195, the Communists and their allies 189, and the right-wing Jan Sangh 46. Threats to Congress supremacy appeared in the loss of an absolute majority in Orissa, in the success in Bombay of a coalition party favoring the division of the state along linguistic lines, and in the election of a Communist government in Kerala. That government was dismissed by presidential proclamation in 1959, however, and the next year was replaced by an elected non-Communist coalition government. The third general election, which took place on Feb. 16–25, 1962, resulted in a slight reduction in the majority of the Congress Party in the House of the People, where it received 361 of the 494 elective seats. Except in Maharashtra, the number of Congress seats in the state assemblies declined, but the party won an absolute majority in all except Rajasthan and Madhya Pradesh, and in these two states it was able to form ministries with independent support.

Jawaharlal Nehru, first prime minister of India (1947–1964), was the undisputed leader of India and of the Congress Party after the assassination of Mohandas Gandhi in 1948. At the time of Nehru's death in May 1964, Gulzarilal Nanda, senior cabinet minister, took over as prime minister, but this was temporary. Within a week, the Congress Party unanimously chose as prime minister Lal Bahadur Shastri. Shastri had previously served as general secretary of the party, had held various cabinet posts, and was one of Nehru's closest advisers.

Foreign Relations.—In the early days of independence, India's attention was directed in the main toward domestic problems, and when the political horizon reached beyond the country's borders, it included only near neighbors. The problems of partition and of establishing a stable and satisfactory relationship with Pakistan were paramount. The bitter hatreds loosed by the communal struggle and the breakdown of law and order in the Punjab drove perhaps 12 million refugees across the borders, more than half of whom came to India. Partition split in half the Punjab and with it the river sources of the vast canal networks that made the region fertile. This division left behind an international dispute that was embittered each time a hydroelectric project threatened to divert water on one or the other side of the border. The original distribution of governmental assets between the two countries was far from peaceful, and contrasting policies on currency devaluation in 1949 resulted in a temporary trade embargo between them. Stories of harassment of religious minorities within the respective countries led to a continuing stream of migrants across

the borders, and a series of riots in Bengal in 1950 brought India and Pakistan to the verge of war. A treaty signed on April 8 of that year by Nehru and Liaquat Ali Khan eased tensions, but relations with Pakistan were not entirely regularized thereafter, and the continuing quarrel over Kashmir kept them strained. A border agreement was reached in 1959, and bilateral talks were held on the Kashmir problem in 1962–1963. But renewed hostilities broke out between the two nations in 1965 until they agreed to a UN cease-fire in September of that year.

On the broader scene, India's influence in world affairs grew immensely after 1947. Although India was a member of the League of Nations, its foreign affairs had been handled through British embassies and commissioner's offices, and its new power was dramatized by the election of Nehru's sister, Madame Vijaya Lakshmi Pandit, as president of the United Nations General Assembly in 1953. A major goal of India's foreign policy in the postwar period was to hasten the end of colonial rule throughout the world. In pursuit of this goal, it supported independence movements throughout Southeast Asia, encouraged Egypt in the Suez Canal crisis of 1956–1957, and exerted continual pressure in the United Nations Trusteeship Council for the rapid granting of sovereignty to dependent areas.

The country also played a central role in encouraging the growth of strong ties among non-Western nations, and it was a leading sponsor of the Asian-African Conference held at Bandung, Indonesia, in 1955. Of particular importance was its courting of friendship with the Chinese People's Republic, which it was the second nation outside of the Soviet orbit to recognize. India repeatedly represented Communist China's case at the United Nations, and, after an initial startled reaction to the Chinese invasion of Tibet in 1950, signed an eight-year agreement (1954) in which it abandoned most of its traditional interest in Tibet and recognized Chinese sovereignty there. When, in 1959, however, the Communist Chinese crushed a revolt of Tibetans against the increasingly dictatorial Chinese rule, India's relations with China were strained. The fleeing Dalai Lama was given refuge in India, and Nehru expressed his disappointment in Communist Chinese conduct. Relations further deteriorated as Communist China laid claim to Indian territory in the Ladakh region of Kashmir and in the North-East Frontier Agency. Beginning in 1959, there were frequent border clashes as Chinese troops moved into the disputed areas. Fruitless talks were held by the two countries in 1960–1961. Then, in October 1962, the Chinese launched a major offensive along the Indian border. After driving the Indian forces back, they announced a cease-fire and withdrew in some areas. Meanwhile, they continued to threaten India in the hope of obtaining recognition of their territorial claims. At India's request the United States and Commonwealth countries furnished military aid.

In general, India assumed an uncommitted role in the cold war. It made great efforts to create and maintain friendly relations with the Soviet Union and the satellite countries of eastern Europe. At the same time, it kept its traditional strong ties with the Western countries, and on more than one occasion played the role of honest broker in cold war disputes. Many nations joined in assisting India's development programs. Financial and technical aid came mostly from the United

States, the Commonwealth, United Nations agencies, the USSR, and West Germany.

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NOTE: The foregoing articles on India were prepared under the joint direction of the editors of THE ENCYCLO-PEDIA AMERICANA and Dr. W. Norman Brown, professor of Sanskrit and chairman, South Asia Regional Studies, University of Pennsylvania.

INDIA RUBBER TREE, the name gen-erally given to *Hevea brasiliensis*, which is in-

digenous to the region of the Amazon River and in the tributary areas of Peru, Bolivia, Ecuador, Colombia, and Venezuela. It is a large tree, of slow growth and long life, requiring low-lying, rich soil and abundant moisture. In Brazil it is found scattered wild through the tropical forest, but in Southeast Asia it is grown on plantations. See also RUBBER.

INDIAN AFFAIRS. Early in the history of the North American colonies it became clear that unrestricted individual dealings with the Indians could result only in confusion and conflict. Individual colonies passed ordinances requiring that the acquisition of Indian land be made by purchase with the concurrence of the governor or of the colonial assembly. This policy was expressed for all the English colonies in a royal proclamation issued Oct. 7, 1763, which declared that "the several nations or tribes of Indians—who live under our protection, should not be molested or disturbed in the possession of such parts of our dominion and territories as, not having been ceded to, or purchased by us, are reserved to them." Trading with the Indians was also early declared a government monopoly. Thus, a pattern of government concern for Indians and government dealings with Indians gradually was woven.

In 1775 the Continental Congress created a committee to deal with the Indians and to assure them of the continued friendship of the new nation to be. The Articles of Confederation conferred on Congress "the sole and exclusive right and power of . . . regulating the trade and managing all affairs with the Indians," and in 1779 the United States Congress adopted a resolution reading in part: "... no land (shall) be sold or ceded by any of the said Indians, either as individuals or as a nation, unless the United States of America, or by the consent of Congress."

On Aug. 7, 1789, responsibility for Indian relations was transferred from a congressional committee to the secretary of war; on March 11, 1824, a Bureau of Indian Affairs was created within the War Department; on June 30, 1834, Congress passed the act which set forth the duties of the Bureau of Indian Affairs and forms the charter for much that is still done by it; and on March 3, 1849, the bureau was transferred to the civilian administration of the newly established Department of the Interior.

Purchase of Indian Lands.—The early policy of government purchase of Indian lands has been adhered to consistently, and it may be fairly said that 2.5 million of the approximately 3 million square miles of the United States have been bought from the Indians. While textbooks place great stress on the Louisiana Purchase and other similar transactions with such countries as Great Britain, France, Spain, Russia, and Mexico, the fact is that all the United States acquired in each of these transactions was the power to govern and to tax. Almost all the ceded territory that was not privately owned by Spanish, French, or Russian settlers was still owned by the Indians, and the property rights of all the inhabitants were safeguarded by the terms of the treaty of cession.

How much the United States paid for this land is a matter of conjecture, for in its land transactions with the Indians many treaties called for payment in land, goods, and services and for tax exemption of their reserved properties. Con-

servatively, these payments might be valued at more than \$1,000,000,000. Moreover, many of the trade goods delivered by the whites, such as knives, firearms, and domestic animals, in their impact on primitive society gave the recipients a valuable technological superiority over other Indian tribes and over their environment which cannot be expressed in terms of money.

Treaties and Legislation.—The conquest and enslavement of new areas by more powerful invaders is part of the historic pattern of human relationships. Indians drove other Indians out of coveted territory when strong enough to do so; on each of the continents the various races and peoples have been continuously in movement, displacing one another as one gained in strength and the other weakened. The discovery, conquest, and settlement of the Americas was simply another chapter in this mass movement of peoples. In North America it differed in one essential aspect from past colonial experiences—early in the relations of the colonies with the Indians, it was established that free purchase and sale was to be the basis of dealings between the natives and the encroaching whites. This decision, however, did not prevent continuing quarrels between Indians and whites on the advancing frontier, a frontier which pushed forward more rapidly than the government was able to extend its authority. Repeatedly government commissions were called in to mediate between whites and Indians, and, while usually finding the whites at fault, the commissions were confronted by an accomplished fact, which remained to be legalized by some compromise not too favorable to the Indians or to the government's reputation for fair dealing.

The earlier theory that the United States government in negotiating with Indians was dealing with independent nations—a theory which led to 371 treaties with Indian tribes—was revoked in 1871 by an act of Congress which declared: "Hereafter no Indian nation or tribe shall be acknowledged or recognized as an independent tribe or power with whom the United States may contract by treaty." Thereafter all Indian legislation was dealt with by both houses of Congress. By 1950 there were on the statute books over 5,000 laws on Indian affairs.

This reservation of responsibility for Indian affairs to the national government has resulted in a proliferation of federal activities on their behalf. Congress legislates on such matters as the control of Indian resources, the determination of Indian tribal membership, the inheritance and distribution of property, jurisdiction over major crimes, and dozens of other municipal matters. Tax exemption of Indian lands, wisely demanded by Indian leaders as part of the purchase price for ceded lands, has made state and local governments reluctant to assume the financial burden of community services. The federal government therefore builds and operates schools and hospitals for Indians, builds and maintains roads and irrigation systems, manages forests and grazing lands, directs an agricultural extension service, and works with individual Indians and their leaders in the establishment of local self-government and in the development of Indian enterprises and reservation programs.

At various times new solutions for the Indian problem have been proposed, and many have been adopted. None have proved to be the immediate panaceas predicted by their supporters. The main reason for this has been that in most instances

the decisions were made for the Indians, not with the Indians, and Indian resistance has served to defeat even the most well-intentioned proposals. It was at first thought that Indians might develop as dependent domestic nations, and the tribes were guaranteed their lands free from the interference of predatory whites and allowed to develop self-government. Since the frontiersmen disregarded the guaranteed rights of the Indians and the government did not enforce them, the project failed. On Feb. 8, 1887, the General Allotment Act was passed by Congress; it was designed to break up the larger reservations into smaller tracts, title to which would be given to individual Indians. It was assumed that individual ownership of property was the secret of American success and would therefore contribute to more rapid civilization and assimilation of the Indians. The restrictions on Indian lands were to continue for 25 years and then terminate. The Indians were then to receive clear title to their individual lands. Many tribes resisted the act, and most of the southwestern reservations were never allotted. In the northern areas where allotment was carried out, more than half of all Indian land was lost by the Indian allottee shortly after the relaxation of restrictions; the inheritance of allotments remaining in Indian ownership has resulted in their continuing subdivision between heirs until the inherited portions are too small for productive use.

During the 1890's general statutes were passed for the leasing of Indian lands to whites in the belief that this would increase their productive use and would stimulate Indians through emulation to better farm and grazing practices. This system also failed, because many Indians who preferred to operate their own lands were coerced into leasing. Deprived of their lands, they settled back to eke out an existence from the lease money.

Indian Reorganization Act of 1934.—The most recent attempt to move toward a solution of the Indian problem was the passage by Congress, on June 18, 1934, of the Indian Reorganization Act (IRA). In brief, this law repealed the allotment act and reimposed restrictions against alienation of Indian lands, to stop their loss; authorized the purchase for, or return to, Indian tribes of alienated lands; provided for sustained-yield operation of Indian forests; authorized the establishment of a revolving loan fund to make loans to individual Indians and Indian chartered corporations; authorized loans to Indians for advanced education; provided means of employing competent Indians in government service regardless of civil service restrictions; and provided the machinery for the organization of Indian tribes for self-government and the management of their own resources. For the first time, Indians were allowed the option of electing to operate under an act or to reject its terms. In 1934-1936, 258 tribal elections were held; 181 tribes, representing 129,750 Indians, voted to accept the act, while 77 tribes, enrolling 86,365 Indians, rejected it. Later amendments extended the operations of the IRA to Oklahoma and Alaska, where the process of tribal choice was not required. Whenever a group or village was ready to organize, it might do so.

The greatest gains under the IRA were: (1) the provision permitting tribes to organize as municipal corporations and to assume self-governing rights similar to those of the average Ameri-

can community and (2) the establishment of a loan fund with which to finance individual or group economic development. From the loan funds available from 1936 to 1948, the United States government loaned \$13,809,000. The delinquency rate in repayments was less than 1 per cent—a better record than had been maintained by federal loan agencies serving non-Indians.

The Indian Service.—The majority of Indians are self-supporting, though at a relatively low economic level. Of the \$48,850,589 appropriated for the operation of the Indian Service in 1949, only \$1,550,941 was expended for direct relief. The remainder was spent for furnishing services authorized by Congress or required by treaty agreements. Of the total, \$14,500,000 was spent on the operation of schools; \$10,250,000, on health services and hospitals; and \$11,500,000, on the construction and maintenance of irrigation projects, roads, schools, hospitals, and agency structures. The administration of these services in Washington and in the field cost about \$4,000,000. In 1949 there were 7,496 full-time civil service employees engaged in Indian work, or about one for every 50 Indians; in the same year there was one federal, state, or local employee for every 24 non-Indians. In addition, the Indian Service, doing its own road work, irrigation, and building construction, had about 3,500 temporary employees. In the case of other government agencies, however, such employees would be working for contractors and would not be counted as government employees. If these temporary workers are added to regular employees, the ratio of employees to Indians was 1 to 30. The per capita cost of government services to Indians in 1949 was \$111.21; the per capita cost of government services (other than military cost and debt retirement) for non-Indians was \$200.

Education.—The school census of 1945 showed a total of 92,296 Indian children of school age. Of these, 31,927 were attending public day schools, 7,813 were in mission boarding schools, and 27,252 were in federal boarding and day schools. During World War II, 5,929 left the reservations with their parents and presumably enrolled in public schools, but there is no accurate record. A total of 19,375 were not in any school; of these, more than 15,000 were on the Navajo Reservation, where adequate school facilities were lacking. Between 1945 and 1950 places were made for about 4,500 Navajos in off-reservation federal boarding schools, and a school building program was undertaken on the reservation.

In 1949, the Indian Service operated 238 schools in the United States and 99 in Alaska. They ranged in size from one-room rural schools to consolidated 12-grade day schools enrolling 450 children. There were 17 nonreservation boarding schools in the United States and 3 in Alaska, and 66 reservation schools which operated boarding departments. Between 1928 and 1948 the number of Indian Service high schools had grown from 2 to 33; since the war the number of high school students has quadrupled. Federal Indian high schools are primarily vocational in program, preparing their graduates to make the best use of their native resources or training them for off-reservation employment. These schools are accredited in their home states, and about 20 per cent of their graduates go on to college or advanced vocational training. The Indian Service has never operated any schools of collegiate grade, but instead has encouraged high

school graduates to attend regular colleges.

Resources.—From 1933 to 1948 the resources activities of the Indian Service more than tripled Indian income from agriculture, stock raising, forestry development, and mineral resources.

Health.—The Indian health service has greatly reduced the incidence of tuberculosis among the Indians, although in areas like the Navajo and Alaska, the death rate was still 10 times that of the white population in 1950. Applying the discovery by Dr. Fred Loe, an Indian Service physician, that sulfanilamide is a specific cure for trachoma, that disease has been eliminated on many reservations and greatly reduced on others. Infant mortality rates were still high in 1950, though the Indian birth rate remained so high that Indians were the most rapidly growing group in the general population.

The Health Branch of the Indian Service operates 64 hospitals in the continental United States and 7 in Alaska. In various clinics and through home visits, over 750,000 treatments are given annually, and more than 50,000 individuals receive hospital care.

As a result of a 10-year study in the United States and Alaska of the use of BCG (*Bacillus of Calmette and Guérin*) vaccination as a tuberculosis preventive, it was found that those who were vaccinated were much less likely to develop tuberculosis, and that among the vaccinated group there were 9 times fewer deaths from the disease. The Indian Service is therefore systematically administering BCG vaccination to children born in Indian Service hospitals and to children in Indian schools. In 1950 the Indian Service was building two tuberculosis hospitals in Alaska, at Sitka and Anchorage, supplying 500 new beds, in addition to approximately 200 beds in older institutions. There are Indian Service tuberculosis hospitals in Albuquerque, N. Mex.; Phoenix, Ariz., and Tacoma, Wash. The Indian Service has built tuberculosis wings for several public hospitals and contracts with their managements for the care of Indian patients. In 1950 additional tuberculosis hospitals were planned for the Navajo area.

Alaska Native Service.—The three native groups of Alaska are under the care of the Alaska Native Service, the title under which the Indian Service operates there. In 1949 the native population of Alaska consisted of about one third of the total, estimated at about 100,000. Indians occupy the interior valleys, and the southeast coastal littoral; Aleuts, the Aleutian Islands, Alaska Peninsula, and the south coast and islands almost to Yakutat; Eskimos, the coastal area, the river deltas, and most of the islands from Bristol Bay north and east to Demarcation Point on the Canadian border. Of the estimated 10,500 children of school age in 1950, 2,950 were attending Alaska territorial schools. About 5,200 were in federal day schools operating in native villages, on in the three boarding schools (of which two are high schools). There were about 600 pupils in mission schools. By 1950, however, no schools had been built in a number of native villages with a total of 1,750 children.

Many Alaskan villages have organized under the IRA, and have borrowed money to buy or build fish canneries, acquire and operate native stores, purchase boats and other fishing gear, and engage in other economic activities. A number of villages have greatly improved their economic status as a result of this development.

Indian Population and Development.—Despite the policy of removal by which the federal government attempted to move as many Indians as possible from the eastern and southern states and to resettle them west of the Mississippi, some Indians are still found in every state of the Union. Those Indians for whom the Bureau of Indian Affairs has a continuing responsibility are those with whom the government has had treaty relations, or for whom it has undertaken some legal responsibility. These live in 24 states (not including New York, where the basic responsibility for the Indians, by colonial treaties, lies with the state). There are more than 15,000 Indians, many of whom are recognized as such by their home states, who have no connection with the Indian Service; most of them live along the Atlantic seaboard and gulf coast. The 1945 census of the Office of Indian Affairs showed 392,000 Indians, compared with a low of 240,000 in 1900 and an estimated 800,000 in 1492.

Oklahoma has the greatest number of Indians, and Arizona is second; California, New Mexico, and South Dakota each have over 20,000. The Navajo is the largest tribe, with more than 65,000. The Sioux are next, followed closely by the Chippewa; both number 35,000 to 40,000.

While many Indian tribes were in 1950 fast moving toward the time when their affairs need no longer be supervised by the government, there were still many tribes which had received little attention in the past and had made little progress toward adapting their ways to modern economic demands. Thousands of individual Indians, however, are constantly taking their places on an equal footing with their white neighbors.

Inter-American Indian Affairs.—The First Inter-American Congress on Indian Affairs was held at Pátzcuaro, Mexico, April 14-24, 1937. Representatives of 19 American nations were present, Canada being the single abstainer among nations with an appreciable Indian population. The United States and Mexico took the leadership in seeking methods for raising the educational, health, and economic standards of the almost 30,000,000 Indians of North, Central, and South America. One of the important results of the congress was the establishment of an Inter-American Indian Institute, with headquarters in Mexico City. The convention authorizing this also provided for the establishment of national Indian institutes in the collaborating nations. Although the United States was quick to approve the convention, Congress, because of World War II, has not appropriated funds for a national Indian institute in the United States. The Second Inter-American Congress on Indian Affairs, held in June 1949, at Cusco, Peru, reviewed and amplified many positions taken at the first meeting.

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WILLARD W. BEATTY,
Chief, Branch of Education, Bureau of Indian Affairs.

INDIAN HEAD, Canada, town in Saskatchewan, 50 miles east of Regina. It has extensive grain interests, lumberyards, a home for

aged men and an orphanage. Situated in a wheat-growing region, Indian Head also has grain elevators and flour mills. An agricultural experiment station and forestry school are maintained here by the government. Pop. 1,802.

INDIAN HEAD, the name of several mountains in the United States.

INDIAN HEAD, New Hampshire, a mountain and tourist settlement, near the Old Man of the Mountain, at the southern extremity of Franconia Notch, named for its close resemblance to an Indian profile.

INDIAN HEAD, Bergen County, New Jersey, the highest point (altitude, 550 feet) of the Palisades along the Hudson River; so called because it somewhat resembles the head of an Indian.

INDIAN HEAD, Greene County, New York, in the Catskill Mountains; altitude 3,585 feet.

INDIAN HEMP (*Apocynum cannabinum*), variously called black Indian hemp or Canada hemp, a member of the dogbane family (Apocynaceae), is a perennial herb about one to two feet high with ascending branches, opposite leaves, and small greenish-white tubular or ovoid flowers. It is found in open ground or thickets throughout eastern North America and west to California. The tough bark yields a crude fiber variously used by American Indians for cordage or weaving. The dried rhizomes and roots of Indian hemp and its closely related species, *A. androsaemifolium*, contain a cardioactive principle, apocynamarin, used as a cardiac stimulant or diuretic. See also DOGBANE.

INDIAN LANGUAGES, American. The Western Hemisphere is the region of greatest native linguistic diversity in the world, with mutually unintelligible native languages counted in the hundreds, and many more dialects. Some native languages are spoken by millions of people; others by a dozen individuals or less. Many languages formerly in use are now extinct, and many others are on the verge of extinction. On the other hand, the discovery of hitherto unknown languages continues to take place. Adequate grammars exist for only a very small fraction of the known languages, and for the majority, little or no morphological data are available. In fact, for very many, the available data are limited to a small vocabulary gathered by a traveler or missionary with little or no knowledge of phonetics.

Any relationship between the American Indian languages and any language of the Old World remains unproved. Suggestions of connections with native Australian or with Malayo-Polynesian languages have not been accepted by American linguists. The most likely possibility, yet unproved, is that a very distant relationship exists between the Na-Dene group, composed of the morphology or grammar of all American Athabaskan, Haida, and Tlingit subfamilies, and the original Sino-Tibetan (Sinitic) linguistic stock.

No general statement can be made concerning the morphology or grammar of all American Indian languages. The popular impression that they are primitive, simple, and lacking in grammatical rules is entirely false. Almost all have morphologies which are more complex than those of Indo-European languages, and probably all have some sounds, unfamiliar to Western ears,

which are not found in European tongues. A few of the American Indian languages possess a pitch accent, such as is found in Chinese.

In the United States, speakers of Indian languages are relatively few, and only a small number of Indians, mainly women, are ignorant of English. The largest group of these are members of the Navaho tribe. In Mexico, Guatemala, Ecuador, Peru, Bolivia, and Paraguay there are millions of natives speaking Indian languages, and, generally, no other.

The most important Indian languages of Mexico and Guatemala are Aztec, Otomi, Zapotec, Mixtec, Tarascan, Totonac, Huastec, Mixe, Maya, and Quiche. Those of South America are Carib, Arawak, Tupi-Guarani, Ge, Quechua, Aymara, Chibcha, Mataco, Guaycuru, Araucanian, Tehuelche, Pano, Tucano, Puinave, and Catukina. Aztec, Maya, Quiche, and Quechua have become secondary culture languages in their respective regions, and standard orthographies were developed for them by the Spanish. Tupi has become a lingua franca for much of Brazil, and Guarani is a secondary language in Paraguay.

The many American Indian languages were originally grouped into some 150 separate stocks, or families, presumably independent and entirely unrelated. These numbered 55 in the United States and Canada, and, according to different authorities, 24 to 30 in Mexico and Central America and 57 to 94 in South America. Already this number has been greatly reduced, and further simplification will follow greater knowledge and study.

Mainly on the basis of studies of similarities in structure, John W. Powell's original grouping of 55 Indian language families in the United States and Canada has been reduced to 5. Although proof is still lacking, this classification generally has been accepted by authorities. It includes: (1) Eskimo-Aleut; (2) Algonkian-Mosan, including the Salish languages; (3) Na-Dene, including Athabaskan, Tlingit, and Haida; (4) Macro-Penutian, including Uto-Aztecan, Sahaptian, Kiowan, Tanoan, Zuni, Maya, Totonac, many languages on the Pacific coast, and others in Mexico; and (5) Hokan-Siouan, a very large group, including Siouan, Caddoan, Iroquoian, Muskogian, Yuman, many languages of California, and some in Mexico and Central America. The latter family may even extend to South America. Most of the languages of Mexico and Central America, as far south as the northern border of Costa Rica, belong either to the Hokan-Siouan and Macro-Penutian groups, or to the great Otomanguean family. Tarascan is apart.

The majority of the South American languages are grouped into phyla, families, or stocks of Cariban, Arawakan, Macro-Tupi-Guaranian, Macro-Ge, Macro-Guaicuruan, Chiquitoan, Kechumaran, and Macro-Chibchan. There are, however, a large number of languages not included in any of the above families, and future studies probably will change this classification greatly. See also INDIANS, AMERICAN.

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INDIAN MUSIC. The music of the Central American and South American Indians has been relatively unavailable; hence, little can be said concerning its style and native function. On the other hand, that of the tribes in the United States and Canada is becoming increasingly well known, through the work of scholars and through commercial recordings, numbering several hundred, which are readily obtainable. There is a large and vital unwritten literature of North American Indian music, which ranges from brief, sometimes comical, love songs and social dance songs to complex ritual chants, which may contain 500 or 600 songs with elaborate texts of symbolic sacred poetry. The music is largely vocal, and musical instruments are used chiefly to accompany the singing. These consist of a large variety of drums and rattles, with a scattering of flutes, flageolets, whistles, and rasps. Among a few groups, even a rare one- or two-stringed fiddle is found.

Although the music varies greatly from tribe to tribe, a few generalizations concerning it may be made. There is almost no part singing. Songs tend to be brief (except in rituals), and the meter is often irregular. The vocal style is frequently very tense and richly ornamented with sharp accents, yells, and the use of falsetto and rough or nasal tones. In a great many cases the melody starts high and moves down as the song progresses. Both on ceremonial occasions and in other contexts the singing is done principally by men.

Despite the fact that only tentative definitions of Indian "music areas" have been made, there are certain stylistic features shared in these areas which are worth mentioning. The Indians of the northwest coast and the Eskimos have recitative-like songs with much changing of pitch and complex rhythms. The melodies of the Great Basin Indians have a small range, are characterized by paired phrases, and are sung with a relaxed voice. Those of the California and Yuma Indians rise part way through the song and are also sung in a relaxed voice. The melodies of the Athabaskan group have only two note values, use large intervals, and may employ falsetto. Characteristic of the Plains Indian songs are their melodic "terraces" and complex phrasing, and their rendition in a very tense voice. Pueblo melodies are like the Plains', but are lower in pitch and are sung in disciplined unison. The music of the Eastern Indians is characterized by antiphonal singing and complex scales.

There are indications that Indian music persists even after other aspects of the culture have been lost. Indians living in New York City meet periodically for "song trades," and a lively exchange of songs takes place when members of different tribes encounter each other in "Indian shows." New religious movements produce new music, such as that of the Shaker Church on the

northwest coast or that of the rapidly expanding pantribal Native American Church (Peyote cult). These songs are Indian in structure, but may show the influence of white American culture in their texts and in some aspects of their religious function. A growing number of social dance songs borrow words and phrases from English and include references in their texts to such contemporary objects as automobiles and airplanes. The following stanza from a skip-dance song, translated from the Navaho, shows both these features:

"Girl friend, buy me a car;
We'll go home in style!
Yippie yai yai, yai yai!"

The white influence on Indian music has been slight so far, but the impact of Indian music on white American culture has a long history. Such composers as Frederick Russell Burton, Charles Wakefield Cadman, Arthur Farwell, Frederick Jacobi, Thurlow Lieurance, Edward McDowell, Ethelbert Nevin, and Charles Sanford Skilton have borrowed extensively from Indian models, adapting Indian motifs to the Western European musical idiom. Authentic as well as imitation Indian songs may be found in grade-school songbooks throughout America, and authentic Indian music is studied and learned in the Boy Scout movement and similar organizations having an interest in Indian lore. The serious study of American Indian music is part of the curriculum in a number of American universities where courses in ethnomusicology are offered.

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INDIAN MUTINY. See INDIA—18. *History: 1707-1947* (British Raj, 1815-1885); *SEPOY—Sepoy Mutiny*.

INDIAN OCEAN, that body of water which is bounded on the north by India and Iran, on the east by the Malay Peninsula, the islands of the East Indies and Australia, on the west by Arabia and Africa, and on the south by Antarctica. The Cape of Good Hope and the southern extremity of Tasmania are usually considered to be the western and eastern limits of the Indian Ocean.

In the southern part, between Africa and Australia, the ocean is about 6,500 miles wide, narrowing gradually northward. Latitudinally, the Indian Ocean ranges from 70°S. to 30°N. With an area of about 28,350,000 square miles, it is the smallest of the three oceans, comprising less than 21 per cent of the ocean-covered part of the globe. Its gulfs are the Red Sea, the Persian Gulf, the Gulf of Oman, the Arabian Sea, the Bay of Bengal, and the Great Australian Bight. Relatively few large rivers flow into the Indian

Ocean. Among them are the Indus, Ganges, Brahmaputra, Irrawady, and Euphrates. The estimated total land area draining into the ocean is about 5,050,000 square miles. Bathymetric surveys made during the latter part of the 19th and early 20th centuries by the *Challenger*, *Gazelle*, and *Valdivia*, and subsequent expeditions of the *Discovery II*, *Willebrord Snellius*, *Dana II*, and other vessels, added considerably to our knowledge of the relief of the ocean floor. A longitudinal ridge, known as the Great Indian Ridge, extends from India to the Antarctic, separating the Western Indian from the Eastern Indian trough. The former extends from the Bay of Bengal to the Antarctic without significant interruptions. The latter is divided up into a series of basins. In the north the Andaman and Nicobar Islands and the Laccadives-Maldives-Chagos archipelago group each mark the site of a great submarine mountain range.

Between India and Africa is the Carlsberg Ridge, believed to continue northward to Murray Ridge, and to the south to the Mid-Indian and Kerguelen ridges. To the southwest of Carlsberg Ridge lies the Seychelles-Mauritius or Mascarene Bank. Occasional submarine gullies like the Swatch-Of-No-Ground in the Bay of Bengal and the Indus Swatch are believed to be either submerged river beds resting on the continental shelf or caused by the deposition of mud and silt brought down by the rivers. The greatest depth in the Indian Ocean is found in the Sunda Trench, where soundings of 7,455 meters have been obtained.

Madagascar is the largest of the Indian Ocean islands. While Ceylon and Socotra are continental islands, the Laccadives and Maldives are essentially coral islands. The Andaman and Nicobar Islands are peaks of a submerged mountain range. Many oceanic islands like Mauritius, Crozet Islands, and St. Paul's are volcanic in origin.

Overlying the basal rocks of the floor of the Indian Ocean are the muds and ooze that have been gradually deposited ever since the ocean first came into existence.

The monsoonal phenomenon in the region north of 10°S. latitude constitutes the outstanding climatic feature of the Indian Ocean. From about October to April northeast winds prevail in the northern latitudes and northwest winds in the southern latitudes. From about May to September south, southwest, and west winds prevail. South of the latitude of the Seychelles, Chagos, and Cocos islands, the southeast trade winds blow during much of the year. South of 30°S. latitude westerly winds, popularly known as the "roaring forties," prevail. Tropical storms or hurricanes are common in the vicinity of Mauritius. In the Arabian Sea and the Bay of Bengal a few hurricane-type storms occur, mostly during the transitional period between the northeast and southwest monsoons.

The surface circulation of the Indian Ocean has a broad general pattern. The ocean currents in the tropical and subtropical latitudes are directly influenced by the southeast trade winds in the Southern Hemisphere and by the alternating northeast and southwest monsoon winds in the Northern Hemisphere. Near the northern end of Madagascar the westerly Equatorial Current divides into the Somali Current flowing north and the Mozambique Current flowing south between Africa and Madagascar. The latter com-

bines with the South Equatorial Current to form the Agulhas Current. Between latitudes 5° and 10°S. there is a reverse flow of water from west to east, constituting the Contra-Equatorial Current. In the southern sector, the southeast trade drift flows eastward. Farther south surface polar water continually moves northward.

In the deepest levels a mass of water of low density and temperature—the Antarctic bottom drift—moves along the bottom as far north as the Arabian Sea and the Bay of Bengal.

The temperature of the surface water is at all times higher than 20°C. (68°F.) in the tropical and equatorial zones. In the Red Sea and the Persian Gulf the temperature often rises much higher. South of 40°S. latitude the water is generally always cool.

In the Arabian Sea and in a belt from southwest Australia to South Africa, the salinity of the ocean water is high. But in areas under the influence of the monsoons, like the Bay of Bengal, salinity is diminished by heavy rainfall and flow of rivers. South of New Amsterdam and St. Paul's, salinity decreases rapidly.

There is some evidence that the ancient Hindus navigated the Indian Ocean. However, historians generally believe that the Phoenicians first explored the northern part of the Indian Ocean in about the 7th century B.C. Necho II, an Egyptian monarch who flourished about 610 B.C., is reported by Herodotus to have sent some of his vessels, manned by Phoenician sailors, into the Indian Ocean, then known as the Erythraean Sea, to circumnavigate Africa. In the 6th century B.C. the ocean was traversed by Hanno, a Phoenician admiral of Carthage. Arrain, the Greek historian, gives us an account of the coastal voyage of Nearchus, one of Alexander's generals, from the Indus to the estuary of the Euphrates. Hippalus, an Egyptian navigator, who lived about the beginning of the Christian era, was the first to observe the regular monsoons of the Indian Ocean, and to profit by them. In the 9th century the Arabs made frequent voyages across the Indian Ocean. In 1486 the Portuguese rounded the Cape of Good Hope and in 1498 Vasco da Gama reached India by the same route. In 1521 a ship of Ferdinand Magellan's squadron crossed the Indian Ocean in the first circumnavigation of the world.

STANLEY S. GHOSH,
Geographer.

INDIAN PAINTBRUSH, a common name for perennial and annual herbs of the genus *Castilleja* of the figwort family (Scrophulariaceae). They comprise about 200 species, almost all in the New World, and especially in the West. The leaves are alternate and usually dissected. The corollas of most species are greenish or yellowish and inconspicuous, with a long upper lip shielding the four stamens and a very short lower lip. The erect spikes of flowers are made conspicuous by the bright yellow, purple, or red (or in one species, white) tips of the calyx lobes and especially of the bracts that subtend the flowers. Many, at least, are parasitic on the roots of other plants.

INDIAN PIPE, common name of *Monotropa uniflora*, a waxy white or flesh-colored herb in the Wintergreen family (Pyrolaceae) native in dark, rich woods throughout North America and westward into Asia. The rather succulent

stems, with small scalelike leaves, arise in clusters from masses of matted, brittle stems, gaining their nourishment as saprophytes on partially decayed organic matter or as parasites on living roots in the soil. The stems are erect, 4 to 10 inches tall, and bear terminal, solitary, nodding flowers. The flowers are bell-shaped, $\frac{1}{2}$ to 1 inch long, with 4 to 5 white or slightly purplish petals that are hairy within and somewhat longer than the 8 to 10 stamens. The 4- to 5-celled ovary matures to an ovoid capsule. A European species of the same genus, *M. hypopitys*, is yellowish in color and has several flowers instead of one.

INDIAN PLANTAIN, a common name for American members of the genus *Cacalia* in the sunflower family. (Compositae), which comprises some 40 species of alternate-leaved perennial herbs also distributed in northeast Asia. The whitish or cream-colored heads are 5—many flowered, without ray florets, and are borne in flat-topped clusters. The largest American species, *C. reniformis*, reaches 9 feet in height, has dilated, fan-shaped leaves 1 to 2 feet broad. It is distributed from New Jersey to Minnesota and south to North Carolina and Tennessee, flowering in the fall.

INDIAN POKE (WHITE HELLEBORE), common names for *Veratrum viride*, a stout, leafy-stemmed perennial herb in the Lily family (Liliaceae) found in wet places across North America. It reaches a height of seven feet, has broadly oval, pointed, and stem-clasping leaves, and large terminal panicles of small yellowish-green flowers. It is hardy and easily cultivated in moist shady spots for bold effects. The roots of this and other members of the genus are very poisonous, and those of a European species, *V. album*, are powdered and sold as a poison for caterpillars; it is also very toxic to other animals and its use is not recommended.

INDIAN RESERVATIONS. A system inaugurated in 1786 by the United States Congress which set aside sections of land to provide homes for Indians removed from their original lands, for the protection of various Indian groups, or to avoid disputes over land boundaries, but most particularly to facilitate the control of Indians by restricting them to specific areas. A natural outgrowth of land cession, this worked two ways, since many tribes "reserved to themselves" by treaty certain portions of those lands being ceded to the United States. Later wording established reservations by Congressional fiat, in that lands obtained from Indian owners included areas "reserved for the exclusive use and occupancy of" specified tribes.

Reservations were established by the following methods, in order of importance: (1) treaty, (2) executive order, (3) act of Congress, (4) grant from foreign sovereigns, and (5) tribal purchase. Title was acknowledged as based upon the rights of prior occupancy, and as a general rule, the Indian living on the reservation could make no lease nor sale of lands, dispose of standing timber, relinquish mining rights, or rights-of-way without Congressional approval, nor could he leave without agency permission. In return, the government was obliged to establish educational facilities, exercise justice, law and order, prevent the intrusion of outsiders, and prohibit the settlement of others on the reserved lands. Since these obli-

gations were frequently ignored, Indians have traditionally resented being forced to observe their restricted status.

With the passage of the General Allotment Act, also known as the Dawes Act, in 1887, this concept was changed to allow individual ownership of reservation lands; however, the total acreage of Indian-held land was so drastically reduced as a result, the allotting of lands was abolished in 1934.

More recent legislation, particularly as embodied in the Indian Reorganization Act of 1934, has secured for the Indian greater freedom of individual action. Indians are completely free to come and go as they wish; passes are not required of occupants or visitors; and, while some confusion still exists over water rights, Indians may capitalize on the timber, mineral, and other resources of their lands. Much of the reservation land today (1957) is owned by the tribe as a whole, although there is a large amount of acreage held by individual Indians as "allotted" land; these parcels may not be sold without government approval. Reservation lands are exempt from property taxes, although Indians pay income and other taxes.

The several reservations today total approximately 42,785,935 acres, which are administered by the Bureau of Indian Affairs, in the Department of the Interior. This agency has divided the United States into 10 administrative districts, each under the authority of an area director, who exercises considerable control of the Indians within his area. The specific reservations are in charge of agents or superintendents who are subject to the authority of the area director. A few state reservations exist, mainly in the east (such as New York, Massachusetts, and Connecticut). In Alaska the Alaskan Native Service administers reservations for Eskimos and Aleuts. The service comes under the jurisdiction of the Indian bureau. See also INDIAN AFFAIRS and the list of reservations in the United States that accompanies the article INDIANS, AMERICAN.

FREDERICK J. DOCKSTADER.

INDIAN RIVER, a long lagoon in eastern Florida; separated from the Atlantic Ocean by a chain of narrow islands, extending about 150 miles southeast from Volusia County to St. Lucie Inlet in Martin County; and navigable as far north as Titusville to vessels of shallow draft. The river is from 300 feet to three miles wide and is in a famous citrus fruit, and resort section.

INDIAN SUMMER, the name given to a period of mild and pleasant weather which generally occurs toward the end of autumn. The term first made its appearance in the last decade of the 18th century. During the next decade the phrase was "second summer." This indicates that the spell of weather known by this name was not, generally noticed much before 1800. The term Indian summer became established about 20 years after its first appearance, which was in western Pennsylvania, and spread to New England by 1798, to New York by 1799, to Canada by 1821, and to England by 1830. The term is, then, not an Americanism; to write in praise of Indian summer is now a literary convention of three continents.

It is by no means easy to account for the origin of the term. The principal characteristics of the season which it describes are haziness,

smokiness, and high temperature. Some explanations of the origin of the term are that (1) the Indians predicted such spells of weather, (2) the smokiness was produced by Indian fires, (3) this was the last season of Indian attacks on white settlements, and (4) the season partook of the Indian character of deceptiveness.

The spell of cold weather preceding Indian summer was known as squaw winter. Terms analogous to Indian summer used in England are St. Luke's summer, applied to a period of warm weather occurring in October, and St. Martin's summer, referring to a similar period in November.

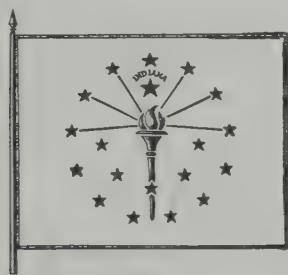
INDIAN TERRITORY. See OKLAHOMA.

INDIAN TOBACCO. See LOBELIA.

INDIAN TURNIP. See JACK-IN-THE PULPIT.

INDIANA, ĭn-dĭ-ăn'ă, East North Central state, United States, bounded on the north by Lake Michigan and Michigan; on the east by Ohio; on the south by the north bank of the Ohio River, which divides it from Kentucky; and on the west by Illinois. It extends about 260 miles from north to south and 150 miles from east to west. Its name means "land of the Indians."

From the 1890 census through that of 1940 the center of population of the United States was located in Indiana, which adopted for its motto "The Crossroads of America." In many ways the state is typical of the nation as a whole, with its balance between manufacturing and agriculture, but its people, who are called Hoosiers (the word is of uncertain origin), give it a distinctive flavor celebrated by such Indiana writers as Edward Eggleston, James Whitcomb Riley, and Booth Tarkington.



State flag
(adopted effective May 31, 1917)



State seal
(adopted Dec. 13, 1816)

A discussion of Indiana's geography, government, social and economic life, and history is presented under the following headings:

- | | |
|---------------------------------------|--------------------------------------|
| 1. Physical Features | 6. Transportation and Communications |
| 2. Population and Political Divisions | 7. Cultural Life |
| 3. Government | 8. Places of Interest |
| 4. Education, Health, and Welfare | 9. Famous Men and Women |
| 5. Economic Activities | 10. History |
| | 11. Bibliography |

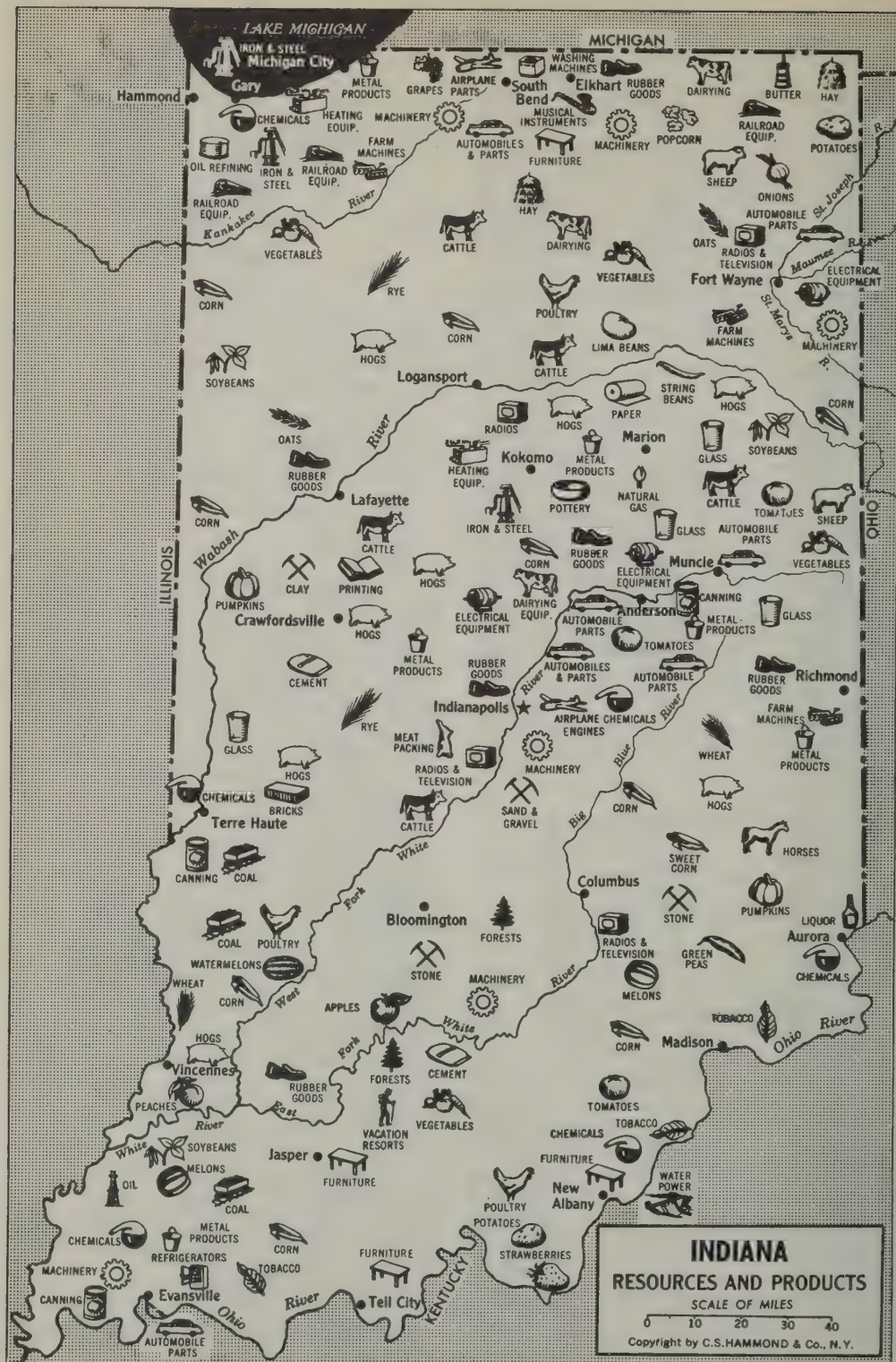
1. PHYSICAL FEATURES

Topography.—The terrain of Indiana is divided into two types—flat or slightly rolling land in the central and northern sections of the state, and hilly country in the south, with the most rugged hills extending southward from Brown County to the Ohio River. There is little poor soil, but the most fertile is to be found in the central third of the state. The rugged terrain of southern Indiana contains numerous small-scale gorges and canyons. In Crawford County are two large caves, Wyandotte and Marengo, and mineral springs are located at French Lick and West Baden in Orange County. Four fifths of the state, in the center and southwest, is drained by the Wabash and its tributaries, the White, Eel, Mississinewa, and Tippecanoe rivers. The northeastern section is drained by the Maumee, which flows into Lake Erie at Toledo, Ohio; the extreme north by the St. Joseph and the Kankakee; and the south by the Ohio. None of the rivers flowing through Indiana is navigable commercially. There are approximately 1,000 lakes in the northern part of the state. The largest is Wawasee Lake, in Kosciusko County, which covers 3,623 acres. Other large lakes, noted also as vacation resorts, are Maxinkuckee, in Marshall County; Freeman, in Carroll County; James, in Steuben County, on which is located Pokagon State Park; Tippecanoe, in Kosciusko County; and Shafer, in White County.

A basic layer of rock was formed in pre-Cambrian times, but all other Indiana rock strata date from the Paleozoic era. Indiana was under water in the Cambrian, Ordovician, and part of the Silurian periods. In the late Silurian and Devonian periods a ridge known as the Cincinnati arch extended northwestward across the state. Thereafter the land rose, and by the end of the Mississippian period, during which the valuable deposits of Indiana limestone were formed, all of Indiana was above water. In the Pleistocene period five sixths of the area of the state was glaciated, forming deep, rich loams. Only south central Indiana is unglaciated, and here the soil is thinner and less productive.

Climate.—The climate of Indiana is mild, but

Total area	36,291 square miles
Land area	36,205 square miles
Water area	86 square miles
Total area including Indiana's share of Lake Michigan	36,519 square miles
Latitude	37°47'—41°46' N.
Longitude	84°48'—88°4' W.
Altitude (average)	700 feet
High point, Greensfork Township	1,240 feet
Low point, Ohio River	320 feet
Population, 1960	4,662,498
Capital city—Indianapolis; population	476,258
Admitted as the 19th state	Dec. 11, 1816
State bird (adopted in 1933)	Cardinal
State flower (adopted in 1957)	Peony
State tree (adopted in 1931)	Tulip tree
State song (adopted in 1913)	<i>On the Banks of the Wabash, Far Away</i>
State motto (adopted in 1937)	The Crossroads of America
State nickname	Hoosier State



there is considerable variation between the northern and southern extremities. The average temperature for the state ranges from 31° F. in winter to 76° F. in summer. The annual mean temperature is 53° for the entire state (49° for the north and 57° for the south). The growing season in central Indiana lasts 188 days. For the state as a whole the average annual precipitation is 39.2 inches, ranging from 35 inches near Lake Michigan to 45 inches along the Ohio. See also RAINFALL.

Plant Life.—When the first settlers came to Indiana, about seven eighths of its area was forested. The trees, mainly hardwoods, were cut down as the land was cleared for farms, and by 1953 only 4,103,000 acres of forest land, or 17.7 per cent of the total area, remained. Some 725,640 acres of land are included in Hoosier National Forest and in land utilization projects.

Of the 134 species of trees represented in the state, the commonest are the oaks, tulip, beech, sycamore, hickories, maples, and black walnut. Dogwood, elderberries, bittersweet, sumac, and Virginia creeper lend color to the countryside, and violets, lupine, anemones, daisies, asters, and many other varieties of flowers grow in fields, on hill-sides, and along streams.

Conservation.—In 1919 the General Assembly created the state Department of Conservation with the purpose of making "every Hoosier a conservationist, who believes in the state and the laws which are in force to conserve its natural resources for the benefit, education and recreation of all Hoosiers now and to come." Largely under the leadership of the department and its divisions of Geology, Entomology, Forestry, Fish and Game, Engineering, Water Resources, Oil and Gas, and State Parks, Lands and Waters, many conservation programs have been carried out. The conservation of land and water resources has also been promoted by a law permitting county forests to be acquired; by the state Stream Pollution Control Board, which endeavors to prevent or control pollution of streams and sources of water by public or private agencies; and by the Indiana Flood Control and Water Resources Commission. A special program in conservation education was instituted in the public schools in 1945, and many private industries and such civic organizations as garden clubs and chapters of the Isaak Walton League lend their assistance to it.

2. POPULATION AND POLITICAL DIVISIONS

Population Characteristics.—Between 1940 and 1950 the population of Indiana rose from 3,427,796 to 3,934,224 or 14.8 per cent. Although this was a larger percentage rise than had occurred in any previous decade of the 20th century, growth after 1950 was at an even higher rate, and by 1960 the population had increased another 18.5 per cent, to 4,662,498. At the time of the 1960 census, 62.4 per cent of the population was classified as urban.

About 98 per cent of the residents of Indiana are native born. Of these, about 5 per cent are non-white, the majority being Negroes. Of the 100,000 or so foreign-born residents, the major groups are the natives of Germany, Poland, the British Isles, Hungary, Canada, Italy, Czechoslovakia, Yugoslavia, the Scandinavian countries, and Greece.

Political Divisions.—Indiana is subdivided into 92 counties, 544 cities and towns, 1,009 townships, and 313 special districts.

Principal Cities.—Of the 19 Indiana cities with populations (1960) greater than 25,000, six—Indianapolis (pop. 1960, 476,258), Fort Wayne (161,776), Evansville (141,543), South Bend (132,445), Terre Haute (72,500), and Muncie (68,603)—are the principal centers of densely peopled areas classified by the census as standard metropolitan areas. Indianapolis, the capital and largest city in the state, is also one of the largest cities in the United States that is not located on navigable water. An active commercial and industrial center, it has plants processing meat and other foods and manufacturing airplane engines, automobile parts, iron and steel products, drugs, foundry and machine shop products, naval ordnance, optical goods, farm implements, printed material, electrical appliances, paper, hosiery and other clothing, and paints and varnishes. Fort Wayne and South Bend, both in the northern part of the state, produce machinery and a wide variety of other goods. Evansville, on the Ohio River, is the leading industrial center of southern Indiana; it produces refrigerators, automobile parts, meat products, furniture, and machinery. Muncie, in the east, has plants producing fruit jars, electrical goods, furniture, and other goods, while Terre Haute, in the west, is the center of the farming and mining area of the Wabash Valley.

The heavily industrialized cities of the Calumet region of northwestern Indiana—Gary (pop. 1960, 178,320), Hammond (111,698), East Chicago (57,699), and Whiting (8,137)—are included in the Chicago metropolitan area, and Clark and Floyd counties are in the Louisville area. The chief industry in the Calumet is the production of iron and steel.

Counties.—Indiana's 92 counties range in size from Ohio (87 square miles) to Allen (671 squares miles), and in population from Ohio (4,165) to Marion (697,567). A list of counties and county seats follows.

COUNTY	COUNTY SEAT	COUNTY	COUNTY SEAT
Adams	Decatur	Lawrence	Bedford
Allen	Fort Wayne	Madison	Anderson
Bartholomew	Columbus	Marion	Indianapolis
Benton	Fowler	Marshall	Plymouth
Blackford	Hartford City	Martin	Shoals
Boone	Lebanon	Miami	Peru
Brown	Nashville	Monroe	Bloomington
Carroll	Delphi	Montgomery	Crawfordsville
Cass	Logansport	Morgan	Martinsville
Clark	Jeffersonville	Newton	Kentland
Clay	Brazil	Noble	Albion
Clinton	Frankfort	Ohio	Rising Sun
Crawford	English	Orange	Paoli
Daviess	Washington	Owen	Spencer
Dearborn	Lawrenceburg	Parke	Rockville
Decatur	Greensburg	Perry	Cannelton
De Kalb	Auburn	Pike	Petersburg
Delaware	Muncie	Porter	Valparaiso
Dubois	Jasper	Posey	Mount Vernon
Elkhart	Goshen	Putlaski	Winamac
Fayette	Connersville	Putnam	Greencastle
Floyd	New Albany	Randolph	Winchester
Fountain	Covington	Ripley	Versailles
Franklin	Brookville	Rush	Rushville
Fulton	Rochester	St. Joseph	South Bend
Gibson	Princeton	Scott	Scottsburg
Grant	Marion	Shelby	Shelbyville
Greene	Bloomfield	Spencer	Rockport
Hamilton	Noblesville	Starke	Knox
Hancock	Greenfield	Steuben	Angola
Harrison	Corydon	Sullivan	Sullivan
Hendricks	Danville	Switzerland	Vevay
Henry	New Castle	Tippecanoe	Lafayette
Howard	Kokomo	Tipton	Tipton
Huntington	Huntington	Union	Liberty
Jackson	Brownstown	Vanderburgh	Evansville
Jasper	Rensselaer	Vermillion	Newport
Jay	Portland	Vigo	Terre Haute
Jefferson	Madison	Warren	Wabash
Jennings	Vernon	Warrick	Williamsport
Johnson	Franklin		Boonville

Knox	Vincennes	Washington	Salem
Kosciusko	Warsaw	Wayne	Richmond
Lagrange	Lagrange	Wells	Bluffton
Lake	Crown Point	White	Monticello
La Porte	La Porte	Whitley	Columbia City

3. GOVERNMENT

Constitution and Elections.—The constitution of Indiana, the second in the history of the state, was adopted in 1851. It may be amended by a majority vote of each house in two consecutive legislatures, followed by a majority vote of citizens voting on the proposal. The constitution has been amended 20 times. No provision exists for the initiative or a referendum except as authorized by specific statute, and even in such cases the vote is not binding on the succeeding General Assembly.



Ewing Galloway

The state capitol building, Indianapolis.

General elections are held in November of even-numbered years. Party primaries at which all officials except United States senators and elected state officials are nominated take place in May of an election year, while nominees for the United States Senate and elective state offices are chosen at party conventions in May or June after the primaries. A presidential preference primary law enacted in 1953 binds national convention delegates to vote according to the wishes of their constituencies on the first ballot. Thereafter they are free to vote as they please.

Any citizen, 21 years of age or over, resident in the state for six months, in the county or township for 60 days, and in the district for 30 days, may vote in Indiana. Registration is permanent, and absentee voting is permitted.

Indiana sends 2 senators and 11 representatives to Congress.

Executive.—The elective executive and administrative officers are the governor, lieutenant

governor, attorney general, clerk of the state Supreme and Appellate courts, and reporter of the state Supreme and Appellate courts, each of whom is elected for a term of four years; and the secretary of state, auditor, treasurer, and superintendent of public instruction, who serve two-year terms. The governor is limited by the constitution to one four-year term in a period of eight years. No limitation applies to the office of lieutenant governor, but the secretary of state, auditor, and treasurer cannot serve more than four years in any six-year period.

The governor appoints the heads of the departments and is responsible for the preparation of the budget. He may veto any measure enacted by the General Assembly, which may override his veto by a majority vote in both houses.

GOVERNORS OF INDIANA

TERRITORIAL GOVERNORS

John Gibson, acting	1800-1801
William Henry Harrison	1801-1812
John Gibson, acting	1812-1813
Thomas Posey	1813-1816

STATE GOVERNORS

Jonathan Jennings	Democratic-Republican	1816-1822
Ratliff Boon, acting	"	1822
William Hendricks	"	1822-1825
James B. Ray	"	1825-1831
Noah Noble	"	1831-1837
David Wallace	Whig	1837-1840
Samuel Bigger	"	1840-1843
James Whitcomb	Democrat	1843-1848
Paris C. Dunning, acting	"	1848-1849
Joseph A. Wright	"	1849-1857
Ashbel P. Willard	"	1857-1860
Abram A. Hammond, acting	"	1860-1861
Henry S. Lane	Republican	1861
Oliver P. Morton	"	1861-1867
Conrad Baker	"	1867-1873
Thomas A. Hendricks	Democrat	1873-1877
James D. Williams	"	1877-1880
Isaac P. Gray, acting	"	1880-1881
Albert G. Porter	Republican	1881-1885
Isaac P. Gray	Democrat	1885-1889
Alvin P. Hovey	Republican	1889-1891
Ira J. Chase, acting	"	1891-1893
Claude Matthews	Democrat	1893-1897
James A. Mount	Republican	1897-1901
Winfield T. Durbin	"	1901-1905
J. Frank Hanly	"	1905-1909
Thomas R. Marshall	Democrat	1909-1913
Samuel M. Ralston	"	1913-1917
James P. Goodrich	Republican	1917-1921
Warren T. McCray	"	1921-1924
Emmett F. Branch, acting	"	1924-1925
Ed Jackson	"	1925-1929
Harry G. Leslie	"	1929-1933
Paul V. McNutt	Democrat	1933-1937
M. Clifford Townsend	"	1937-1941
Henry F. Schricker	"	1941-1945
Ralph F. Gates	Republican	1945-1949
Henry F. Schricker	Democrat	1949-1953
George N. Craig	Republican	1953-1957
Harold W. Handley	"	1957-1961
Matthew E. Welsh	Democrat	1961-1965
Roger D. Branigan	"	1965-

Legislature.—The Indiana General Assembly, which meets in regular session on the Thursday after the first Monday in January of odd-numbered years, consists of a Senate of 50 members elected for four-year terms, half of them every two years, and a House of Representatives of 100 members elected biennially. The length of regular sessions is limited to a maximum of 61 days. Special sessions called by the governor are limited to 40 days each.

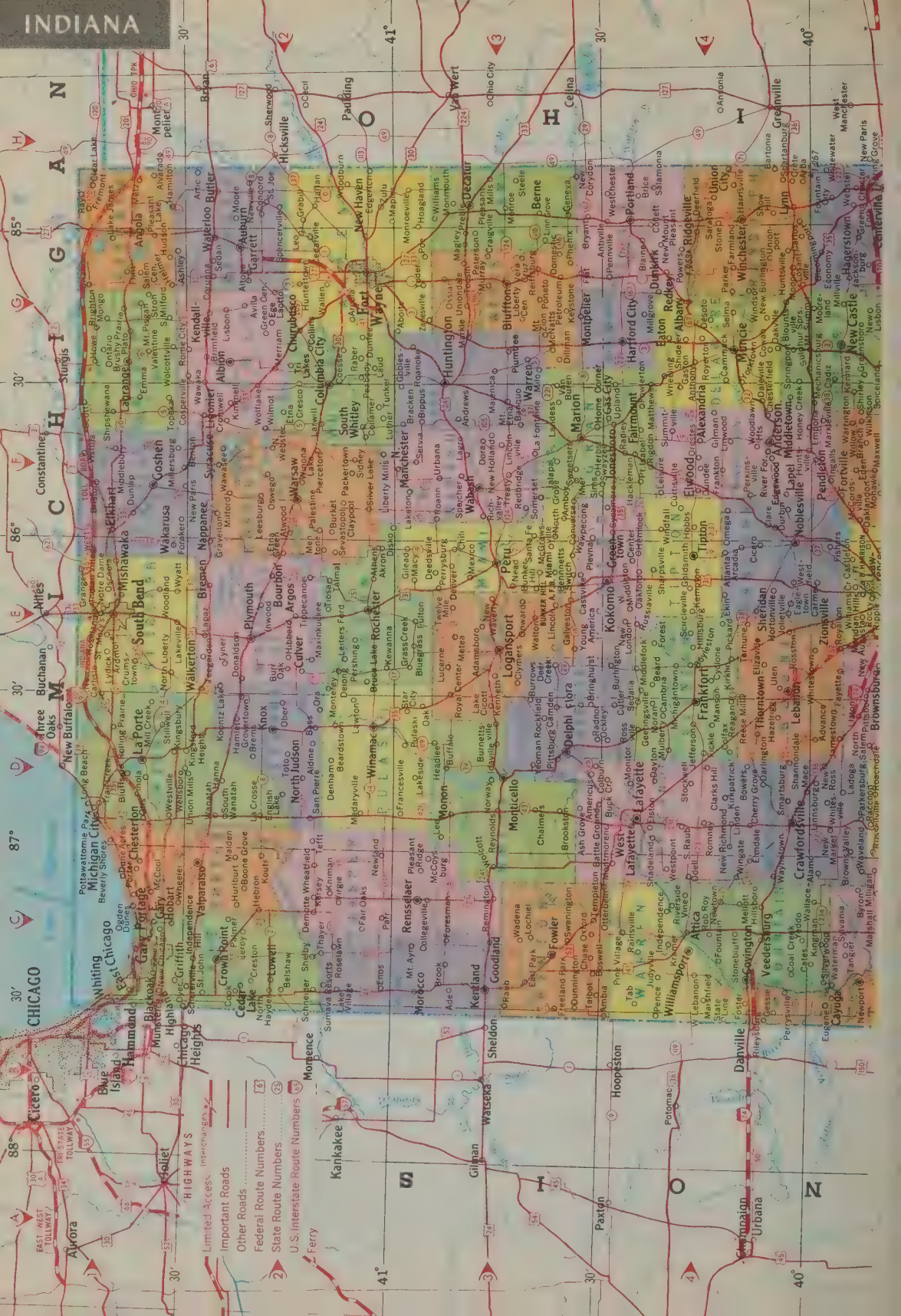
Judiciary.—The highest court in the state is the state Supreme Court, which, together with circuit courts and justice of the peace courts, was created by the constitution. The five justices of the Supreme Court are elected on party tickets for six-year terms. The Appellate Court, which was created by the 1891 General Assembly to assist the Supreme Court, consists of eight judges

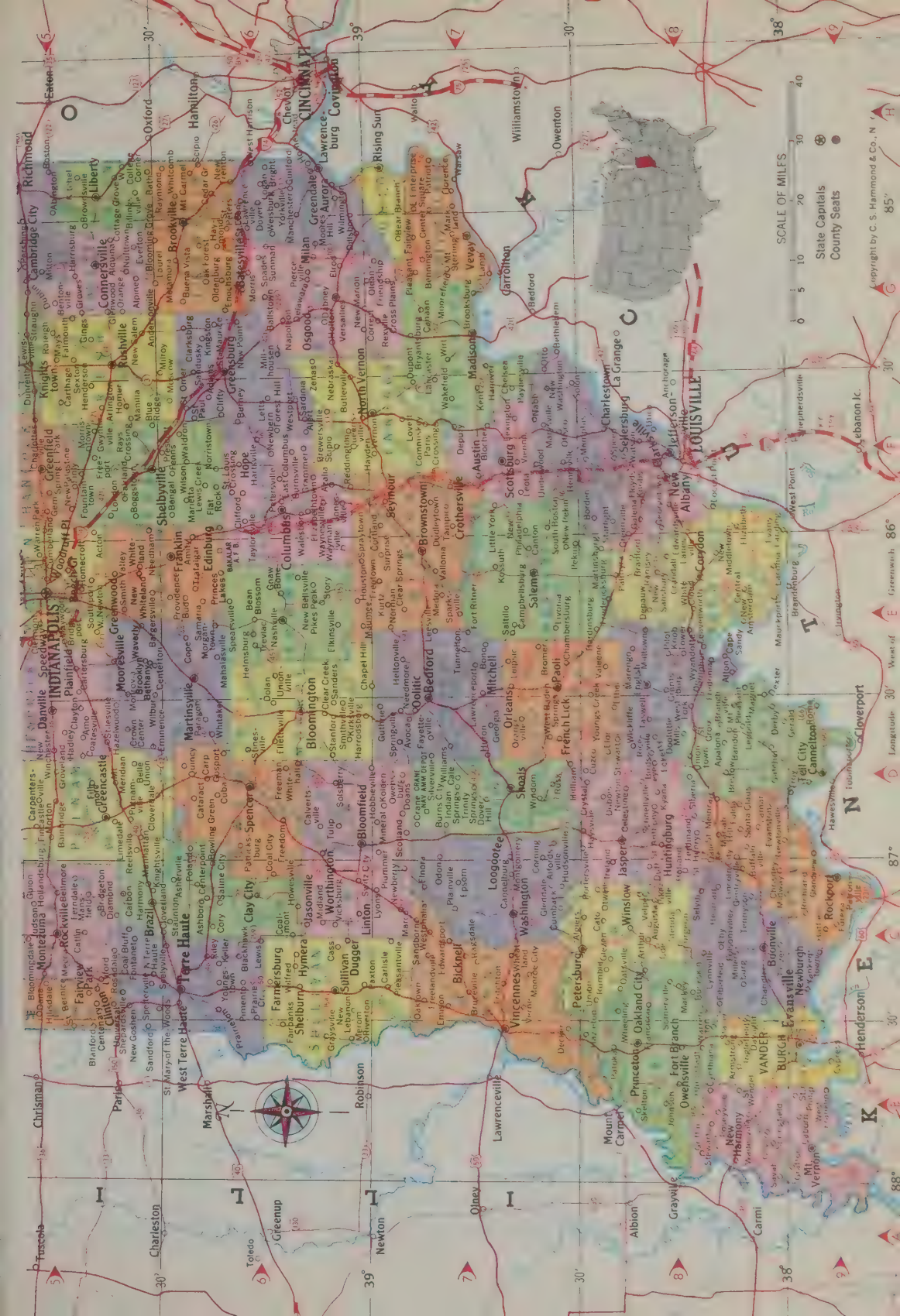
1960 Final Census 4,662,498; 1965 Est. 4,885,000

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● County Seat. ‡ Name not on map.
All figures available from 1960 final census are supplemented by local official estimates.

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SCALE OF MILES

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State Capitals
County Seats

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1960 Final Census 4,662,498; 1965 Est. 4,885,000

195	Marco (EB)	144	Onward (E3)	153	Reisville (D5)	150	Shelbville (F5)	14,317	Tippecanoe (E2)	300	West Newton (E5)	305	City (creek)	C
803	Mount Auburn (C1)	186	Oolitic (E3)	1140	Remington (C3)	1,207	Shenandoah (B5)	332	Tippecanoe (E4)	5604	West Newton (E5)	300	Coal (creek)	C
257	Marah Hill (D8)	142	Orestes (F4)	307	Rensselaer (C3)	4,740	Shider (G4)	2165	Toneka (F1)	600	West Terre Haute (B6)	1,206	Crane Naval Arm	C
250	Mount Carmel (H6)	192	Oland (F4)	424	Reynolds (D3)	547	Shider (G4)	2165	Toneka (F1)	600	West Terre Haute (B6)	1,206	Dept	D
37,854	Mount Elma (F3)	424	Oleola (E1)	1,659	Richland (C9)	500	Shipsheana (F1)	312	Town of Pines (D1)	939	Westport (C4)	280	Crooked (creek)	E2
400	Mount Summit (G4)	590	Oleola (E1)	1,350	Richmond (H5)	44,149	Shirley (F5)	1,038	Tralafalg (E9)	883	Westport (F6)	883	Deer (creek)	E3
400	Mount Vernon (B9)	520	Oleola (E1)	1,350	Richmond (H5)	44,149	Shirley (F5)	1,038	Tralafalg (E9)	883	Westport (F6)	883	Deer (creek)	E3
400	Mulberry (C4)	1,082	Oogood (G6)	1,434	Ridgeway (G4)	950	Shirley City (Woodburn)	585	Trail Creek (E5)	1,352	Whitfield (C2)	789	Eagle (creek)	E4
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elected on party tickets for four-year terms. By legislative enactment the state is divided into 84 judicial circuits, each with a circuit judge who is elected for six years and has jurisdiction over civil and criminal cases; 8 of the circuits comprise two counties each, and the remainder cover one county each. Each circuit elects a prosecuting attorney for a four-year term to handle criminal cases. Additional courts, created by the General Assembly to assist the circuit courts in the more populous counties, include superior courts in 17 counties; probate courts in Marion, St. Joseph, and Vanderburgh counties; criminal and juvenile courts in Marion and Lake counties; and a municipal court in Marion County.

Taxation and Revenue.—A constitutional provision which prevents the state from contracting any debts has helped to establish state finances on a pay-as-you-go basis. Bonds issued by local units of government are limited by constitutional provision to 2 per cent of the assessed valuation of each unit. Approximately four fifths of Indiana's general fund revenues are derived from taxes, of which the principal types are the general sales and gross receipts taxes, a motor fuel tax, alcoholic beverage taxes, motor vehicle licenses, and tobacco taxes, including a per package levy on cigarettes.

Local Government.—The principal units of local government are counties, cities, and towns. County officers provided by the constitution are the clerk of the circuit court, auditor, recorder, treasurer, sheriff, coroner, and surveyor, each of whom is elected for a 4-year term. Except for the surveyor, these officers are limited to 8 years of service in any 12-year period. In addition, there are a Board of County Commissioners, composed of three members elected from districts and entrusted with control of county property; and a seven-member County Council, which approves the county budget, sets the county tax rate, and authorizes county appropriations and bond issues. The county assessor, who is elected for a term of 4 years, supervises the assessment of property for tax purposes.

Cities are divided into five classes by population: first, 250,000 or over; second, 35,000 to 250,000; third, 20,000 to 35,000; fourth, 10,000 to 20,000; and fifth, 2,000 to 10,000. All of them follow the mayor-council form of government. First- and second-class cities have nine councilmen each; third- and fourth-class cities, seven; fifth-class cities, five. The mayor, clerk, councilmen, and, in larger cities, the city judge are elected for 4-year terms. Towns are incorporated places with populations of less than 2,000, or places with larger populations which have elected to continue to operate as towns. Each town elects a board of three to seven members and a town clerk, who serve 4-year terms.

4. EDUCATION, HEALTH, AND WELFARE

Education.—The Ordinance of 1787 creating the Northwest Territory stipulated that since religion, morality, and knowledge are "necessary to good government and the happiness of mankind, schools and the means of education shall forever be encouraged," and the state constitution of 1816 set forth that "it shall be the duty of the General Assembly, as soon as circumstances will permit, to provide, by law, for a general system of education, ascending in a regular gradation, from township schools to a State University, wherein tuition shall be gratis, and equally open to all."

The educational system envisioned under this far-seeing provision was not, however, to be established for many years. The primary efforts of the first settlers were devoted to clearing forests, draining swamps, building log homes, and cutting roads.

Although a permissive educational system was established by the General Assembly, there was no efficient organization, and by the mid-19th century increasing numbers of people began to realize that educational facilities had to be improved. The foundations of the present school system were laid by the constitution of 1851, which provided for a state superintendent of public instruction, and the General School Act of 1852, which established a state Board of Education and set forth an educational program. The successful fight for tax-supported schools "free and open" to all was led by Caleb Mills, Wabash College professor and president.

The duties of the state Department of Public Instruction include administration of the public elementary and secondary schools, school relief and inspection, teacher training and licensing, vocational education and rehabilitation, and school health and attendance. Indiana has had a compulsory attendance law since 1897, and since 1901 attendance between the ages of 7 and 16, inclusive, has been required. Enrollment in the public schools rose from about 500,000 in 1900 to over 1 million in the 1960's.

Indiana has four state-supported institutions of higher learning: Indiana University, Bloomington, with medical schools and a law branch at Indianapolis and with adult education centers scattered throughout the state; Purdue University, Lafayette, and its extension centers; Indiana State College, Terre Haute; and Ball State Teachers College, Muncie. Private colleges include Anderson College and Theological Seminary, Anderson; Butler University and Indiana Central College, both in Indianapolis; DePauw University, Greencastle; Earlham College, Richmond; Evansville College, Evansville; Franklin College of Indiana, Franklin; Goshen College, Goshen; Hanover College, Hanover; Indiana Technical College, Fort Wayne; Manchester College, North Manchester; St. Mary's College (for women) and the University of Notre Dame (for men), both in Notre Dame; St. Joseph's College (for men), Collegeville; Taylor University, Upland; Tri-State College, Angola; Valparaiso University, Valparaiso; and Wabash College (for men) Crawfordsville. College enrollment rose from 5,000 in 1900 to over 100,000 in the 1960's.

Libraries.—Although free public libraries were instituted as part of the public school system established in 1852, most public libraries in the state are independent corporations without direct connection with the public school system. Among the largest of the public library systems in Indiana are the Indianapolis Public Library, which has special collections of children's literature and Indiana authors; the Public Library of Fort Wayne and Allen County; the Gary Public Library; the Indiana State Library, which has a large collection of material on Indiana history; the Evansville Public and Vanderburgh County Public Library; and the South Bend and Hammond public libraries. The largest of the university libraries is that of Indiana University, which has special collections of American literature and American and Indiana history. That of the University of Notre Dame has material on

medieval history, while the Purdue University Libraries are known for their industrial and Indiana collections.

Public Health and Welfare.—The state Board of Health appoints the director of the state Department of Health, which is charged with the administration of public health measures. Under its jurisdiction are the Indiana State Hospital for Chest Diseases at Rockville and Southern Indiana Tuberculosis Hospital at New Albany, and the James Whitcomb Riley Hospital for Children in Indianapolis. A separate Division of Mental Health supervises state hospitals for the mentally ill at Indianapolis (two), Logansport, Richmond, Evansville, Madison, and South Bend; a hospital for the criminally insane at Westville; the Fort Wayne State School in Fort Wayne and the Muscatatuck Colony at Butlerville, for the care and training of the mentally defective; and the New Castle State Hospital, at New Castle. The Indiana Council for Mental Health, created in 1945, has authority to prescribe methods of psychiatric treatment, to set up standards of training for hospital employees, and to organize mental hygiene clinics. Medical and psychiatric care take precedence over custodial care.

The state Department of Public Welfare is responsible for administration of assistance to aged and blind persons, aid to dependent children, and services for crippled children; the supervision of child welfare agencies; and the licensing of nursing homes. The state Department of Correction administers the Indiana State Prison at Michigan City, the Indiana Reformatory at Pendleton, the Indiana State Farm at Greencastle, the Indiana Women's Prison and Indiana Girls' School, both at Indianapolis, and also the Indiana Boys' School at Plainfield. Other state institutions are schools for the deaf and the blind at Indianapolis, a soldiers' home at Lafayette, and a home for the children of soldiers and sailors at Knightstown.

5. ECONOMIC ACTIVITIES

Indiana ranks among the 10 leading states both in value of manufactures and in cash income from farms. The state's per capita personal income, which fluctuates close to the national average, rose from \$553 in 1940 to \$1,520 in 1950 and to \$2,181 in 1960.

Labor.—The state's labor force comprises over 1,600,000 workers. Manufacturing accounts for about 600,000, wholesale and retail trade for 300,000, federal, state, and local government for 200,000, and agriculture for 115,000.

In 1945 Indiana's labor and management leaders adopted the first state labor-management charter, calling for the amicable settlement of labor disputes. In 1954 a successful voluntary mediation and conciliation service was set up by the governor. Indiana adopted a right-to-work law in 1957 to become the first major industrial state to ban the union shop. The state has also enacted legislation barring injunctions in labor disputes. Earlier voluntary fair employment practices were strengthened in 1963 when the legislature passed laws prohibiting discrimination in employment because of race, creed, or color.

Agriculture.—The number of farms in Indiana, as in the United States generally, has declined. The state had 185,000 farms in 1940, 167,000 in 1950, and fewer than 130,000 in the 1960's. The average size of farms, on the other hand, increased from fewer than 120 acres in 1950

to more than 145 acres in the 1960's. The total amount of land in farms has remained relatively constant at just under 20 million acres, valued in the 1960's at about \$275 per acre. This value represented a sizable increase over the 1950 figure (\$136 per acre) and was more than double the national average (\$115 per acre).

About three fifths of Indiana's cash farm income is derived from the sale of livestock and livestock products, of which the most important, in order of value, are hogs, cattle and calves, dairy products, eggs, and broilers. The most valuable cash crop is corn, which ranks second only to hogs as an income producer. The second crop is soybeans, and in the production of both corn and soybeans Indiana normally ranks second or third in the nation. Other leading crops are wheat, tomatoes, oats, tobacco, hay, apples, popcorn, red clover seed, cantaloupes, watermelons, rye, strawberries, peaches, and lespedeza seed. The state is the chief United States producer of spearmint and peppermint, which are raised in the rich muck soil of the northern section. Other important muck crops are potatoes, cabbages, onions, celery, and carrots.

Mining.—Coal is Indiana's leading mineral product. There are approximately 70 mines in the state. Coal is obtained in about 15 counties, but almost nine tenths of total production comes from the 5 counties of Vigo, Warrick, Pike, Greene, and Sullivan. Of the total output, approximately 70 per cent is yielded by strip pits.

Indiana ranks first among the states in the production of building stone, and Indiana limestone is known as the nation's building stone. It is quarried in Monroe, Lawrence, and Owen counties. Indiana limestone was the construction material used for the Rockefeller Center buildings in New York, the Pentagon and numerous other federal buildings in Washington, and many state capitols.

The state also ranks high in the production of ceramics. Most of the clay is found in the west central part of Indiana, and Brazil, seat of Clay County, describes itself as the clay center of the world. Among the products made from Indiana clay are brick and tiles, terra cotta, flowerpots, conduits, jars, and vases.

Another important mineral resource is petroleum. In addition, the state is an important producer of sand, gravel, and cement.

Manufacturing.—The number of manufacturing establishments in Indiana increased from about 4,000 in 1940 to over 6,500 in the 1960's; value added by manufacture rose from less than \$1 billion to over \$6 billion. Almost all the important types of manufacturing are represented. Leading in value are the primary metal industries, of which steel is the most important component. Indiana is exceeded in basic steel production only by Pennsylvania and Ohio, and the Calumet area of Lake County, center of most of the state's basic steel production, is one of the world's largest industrial concentrations. The Gary Steel Works of the United States Steel Corporation is the second largest steel plant in the world.

Other leading industries in Indiana are electrical machinery; food and related products; chemicals and chemical products; nonelectrical machinery; fabricated metals; transportation equipment; stone, clay, and glass products; printing and publishing; rubber and plastic products; and petroleum and coal products.

Power.—About three fifths of the coal mined in Indiana in the 1960's was consumed by electric utility companies, with a capacity of over 6,700,000 kilowatts of electric energy. Other industries had a capacity of about 800,000 kw. Hydroelectric capacity was only 31,000 kw, although undeveloped hydroelectric power was estimated at 700,000 kw.

Banking.—Indiana had a total of about 450 banks in the 1960's, a decrease of about 8 percent from 1950. Bank deposits, however, increased from under \$4 billion in 1950 to over \$5 billion in the 1960's. There are more than 200 savings and loan associations with total assets of approximately \$2 billion.

For additional production statistics, see *THE AMERICANA ANNUAL*.

6. TRANSPORTATION AND COMMUNICATIONS

Indiana's modern highway system covers about 90,000 miles, of which 80,000 miles are surfaced. It includes such heavily traveled federal highways as U.S. 40 (the old National Road) and U.S. 30 (Lincoln Highway), principal coast-to-coast routes, and U.S. 31 (Dixie Highway) and U.S. 41, leading north-south routes, as well as the Indiana Turnpike, completed across the northern part of the state in 1956.

All main railroad lines east of Chicago and many vital north-south arteries pass through Indiana, and Indianapolis is the world's largest inland railroad center not on navigable water. Some 30 railroads, with a combined line mileage of over 6,000 miles, operate in the state.

Indiana, strategically located on the chief north-south and east-west air routes, is served by American, Delta, Eastern, Lake Central, North Central, Ozark, Trans World, and United airlines and a Chicago helicopter line for passengers, and by Slick Airways for freight. The state has more than a hundred commercial airports.

Through Lake Michigan on the north and the Ohio River on the south, Indiana has access to the Great Lakes and the inland waterway system. Gary and Indiana Harbor (the port of East Chicago) are the most important lake ports.

In the 1960's the state had 2 million telephones, over 90 radio stations, 17 VHF and UHF television stations, and 90 daily newspapers.

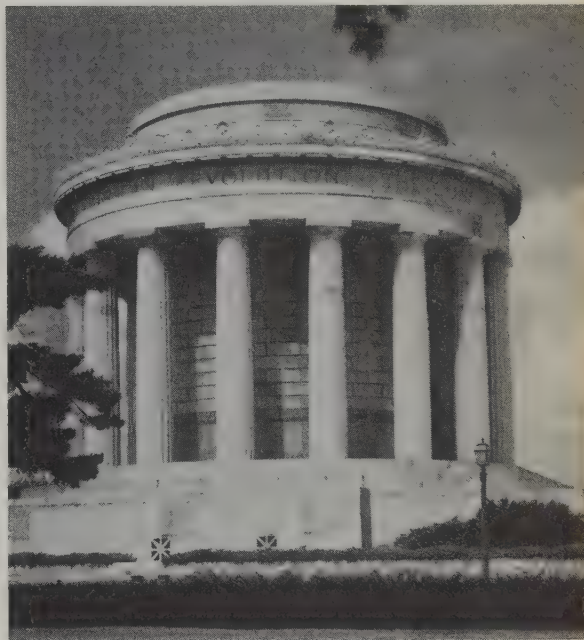
7. CULTURAL LIFE

In 1890 there was probably hardly a literate person in the United States who had not read Edward Eggleston's *Hoosier Schoolmaster*, some of the incomparable poems of James Whitcomb Riley, or Gen. Lew Wallace's *Ben Hur*. At or soon after the turn of the century many more books had come from the pens of Indiana authors, including *When Knighthood Was in Flower* by Charles Major, *The Song of the Cardinal* by Gene Stratton Porter, *Graustark* by George Barr McCutcheon, *Fables in Slang* by George Ade, and *The Gentleman from Indiana* by Booth Tarkington. Among more recent writers who have continued the Indiana literary tradition are Meredith Nicholson, Theodore Dreiser, Albert J. Beveridge, Ross Lockridge, Jr., Jeannette Covert Nolan, and the World War II GI's columnist, Ernie Pyle.

Interest in state history is fostered by the Indiana Historical Society in Indianapolis, the Allen County-Fort Wayne Historical Society, and the Northern Indiana State Historical Society in South Bend. Indiana University in Bloom-

ington publishes the *Indiana Magazine of History*.

The Art Association of Indianapolis, organized in 1883, maintains the John Herron Art Institute, which is widely known for its teaching of art and has the best museum in the state. Other collections of paintings are displayed in the Fort Wayne Art School and Museum, at Ball State Teachers College in Muncie, and in the O'Shaughnessy Liberal and Fine Arts Hall of the University of Notre Dame. There are a number of local art associations, and in the little town of Nashville in Brown County live many artists, particularly painters. Brown County is a mecca for art lovers and artists, and many well-known studios are clustered in its picturesque hills.



Ewing Galloway

The George Rogers Clark State Memorial at Vincennes.

Indiana has made noteworthy contributions in the field of music. The popular music of Cole Porter, Hoagy Carmichael, and others is internationally known. Connersville is reputed to have been the first city in the United States to have a public high school band, and Richmond claims to have had the first high school symphony orchestra. Perhaps the greatest impact has been made by the Indianapolis Symphony Orchestra (q.v.) and the Indiana University School of Music. Two members of the school's faculty, S. Thomas Beversdorf and Bernhard C. Heiden, are nationally known composers and conductors.

8. PLACES OF INTEREST

Indiana's state park system, one of the finest in the United States, was established in 1916 under the direction of Col. Richard Lieber. It comprises about 35 parks and beaches with a combined area of over 50,000 acres. The parks were developed both for recreation and to conserve typical Indiana scenery and geological formations. They are

scattered from the sand dunes of Lake Michigan to the rugged hills and cliffs along the Ohio River. With their locations they are as follows: Bass Lake, Starke County; Brown County, near Nashville; Clifty Falls, near Madison; Indiana Dunes, near Chesterton; Kankakee River, near Schneider; Lieber State Park, near Cloverdale; Lincoln, containing the site of the cabin occupied by the Lincoln family during their stay in Indiana, near Lincoln City; McCormick's Creek, near Spencer; Mounds, which has the largest Indian earthworks in the state, Anderson; Muscatatuck, near North Vernon; Pokagon, near Angola; Scales Lake, near Boonville; Shades, near Waveland; Shakamak, near Hymera; Spring Mill, which contains a reconstructed pioneer village, near Mitchell; Tippecanoe River, near Winamac; Turkey Run, near Marshall; Versailles, near Versailles; and Whitewater, Union County. There are also state and municipal forests with a total of over 100,000 acres; state fish hatcheries with rearing and display ponds; and about 15 game preserves.

In addition, there are 14 state memorials, which include the first state capitol, at Corydon; the territorial capitol and the George Rogers Clark State Memorial, both at Vincennes; the Tippecanoe Battlefield State Memorial, near Lafayette; and Angel Mounds, the largest group of Indian mounds in the state, near Evansville. Also in Vincennes are William Henry Harrison's home and the Cathedral of St. Francis Xavier, built in 1825-1841. In New Harmony are the buildings of the Rappite colony, and in the city park at Rockport is a reconstructed Lincoln village. The State Capitol in Indianapolis is an imposing structure built of Indiana limestone in 1878-1888. Among other notable buildings in the capital are the Scottish Rite Cathedral, which has a carillon of 63 bells; the Soldiers and Sailors Monument; and the World War Memorial. In Madison, Vevay, South Bend, and Fort Wayne are a number of houses erected in the early 19th century.

9. FAMOUS MEN AND WOMEN

Men and women born in Indiana have attained fame in many fields. In statesmanship they have included three secretaries of state—Walter Q. Gresham (near Lanesville, 1832-1895), John W. Foster (Pike County, 1836-1917), and John M. Hay (Salem, 1838-1905); a vice president, Thomas R. Marshall (North Manchester, 1854-1925); the senators Oliver Perry Morton (Salisbury, Wayne County, 1823-1877) and James E. Watson (Winchester, 1863-1948); Paul V. McNutt (Franklin, 1891-1955), chairman of the War Manpower Commission; and Wendell L. Willkie (Elwood, 1892-1944), most expressive advocate of One World.

Among Indiana's many writers are Lew Wallace (Brookville, 1827-1905), John James Piatt (Milton, 1835-1917), Edward Eggleston (Vevay, 1837-1902), Joaquin Miller (Liberty, 1839-1913), Maurice Thompson (Fairfield, 1844-1901), James Whitcomb Riley (Greenfield, 1849-1916), Charles Major (Indianapolis, 1856-1913), Annie Fellows Johnston (Evansville, 1863-1931), George Ade (Kentland, 1866-1944), George Barr McCutcheon (near Lafayette, 1866-1928), Meredith Nicholson (Crawfordsville, 1866-1947), Gene Stratton Porter (Wabash County, 1868-1924), William Vaughan Moody (Spencer, 1869-1910), Booth Tarkington (Indianapolis, 1869-1946), Theodore Dreiser (Terre Haute, 1871-1945), Charles A. Beard (Knightstown, 1874-1948), Mary R. Beard (Indianapolis, 1876-1958), Lloyd C. Douglas (Columbia City, 1877-1951), Claude G. Bowers (Hamilton County, 1878-1958), George Jean Nathan (Fort Wayne, 1882-1958), Robert S. Lynd (New Albany, 1892-), Ernie Pyle (Dana, 1900-1945), and Ross Lockridge, Jr. (Bloomington, 1914-1948). To the world of art, Indiana has contributed the painters Theodore Clement Steele (Owen County, 1847-1926), William Merritt Chase (Williamsburg, 1849-1916), Otto Stark (Indianapolis, 1859-1926), and Wayman Adams (Muncie, 1883-1959); and the sculptor Janet Scudder (Terre Haute, 1873-1940). Paul Dresser

(Terre Haute, 1858-1906), Cole Porter (Peru, 1893-), and Hoagy Carmichael (Bloomington, 1899-) became celebrated as composers of popular music.

Other famous Hoosiers are James B. Eads (Lawrenceburg, 1820-1887), inventor of the diving bell; Ambrose E. Burnside (Liberty, 1824-1881), Civil War general; the chemists Harvey W. Wiley (Kent, 1844-1930) and Harold C. Urey (Walkerton, 1893-); William T. Hornaday (Plainfield, 1854-1937), zoologist; Eugene Debs (Terre Haute, 1855-1926), labor leader; Elwood Haynes (Portland, 1857-1925), inventor of the first successful clutch-driven automobile; Wilbur Wright (Millville, 1867-1912), pioneer in aviation; Will H. Hays (Sullivan, 1879-1954), president of the Motion Picture Producers and Distributors of America; Eli Lilly (Indianapolis, 1885-), drug manufacturer; Elmer Davis (Aurora, 1890-1958), news analyst; and Lewis B. Hershey (Steuben County, 1893-), director of the Selective Service System.

10. HISTORY

In common with other regions of the Ohio and Mississippi valleys, the territory which now comprises the State of Indiana was once occupied by a prehistoric Indian people popularly called Mound Builders (see MOUND BUILDERS AND MOUNDS). Their earthen forts and embankments, mounds, and village sites dating back to pre-Columbian times are found in about one third of Indiana's 92 counties. The most important of the Indian tribes in historic times was the Miami (see MIAMI INDIANS).

Indiana's recorded history began late in the 17th century, when Robert Cavelier, sieur de La Salle, explored the region. Following one of the two principal routes by which the early French explorers traveled from the Great Lakes to the Mississippi River, La Salle and a party of 28 men camped one night in December 1679 on the south bend of the St. Joseph River, en route from Lake Michigan to the Kankakee and Illinois rivers. La Salle returned to this area in the spring of 1681 and, as part of his plan to build a series of French forts from Lake Ontario to the mouth of the Mississippi for the protection of the Western Indians and the fur trade against the Iroquois tribes, held conferences with the Miami and Illinois Indians under a great tree, later known as the Council Oak, at what is now South Bend. La Salle influenced the Indians to move into Illinois, but early in the 18th century the tribes began to return to Indiana, settling on the Maumee, Wabash, and White rivers. During that century, Shawnee, Miami, Delaware, Potawatomi, Kickapoo, and other Indians roved the trackless wilds of Indiana.

In the first third of the 18th century the French established three forts and trading posts in the area. Fort Miami was erected at what is now Fort Wayne, and Fort Ouiatenon was built about 1720 on the Wabash near the site of Lafayette. The most important and only permanent one of the three posts, however, was that established in 1731 or 1732 at Vincennes by Francois Marie Bissot, sieur de Vincennes, in whose honor it was named.

Relatively few French colonists had settled in Indiana by 1763, when the Treaty of Paris ended the French and Indian War with the cession to Great Britain of all lands east of the Mississippi. British soldiers were sent to garrison Western posts, and the Indian region came under the jurisdiction of Col. Henry Hamilton, lieutenant governor at Detroit.

Forseeing the importance of the Old Northwest to the American cause in the Revolutionary War, George Rogers Clark, with financial backing from Governor Patrick Henry of Virginia,

recruited a small army which in the summer of 1778 captured Kaskaskia and took over Fort Sackville at Vincennes. Hamilton, coming down from Detroit, recaptured Fort Sackville in December 1778. Clark, who had remained at Kaskaskia, headed eastward and, after pushing through the flooded lands along the Wabash, surprised Hamilton at Vincennes and forced his surrender on Feb. 25, 1779.

By the Treaty of Paris, in 1783, Great Britain ceded the territory northwest of the Ohio River to the United States. Virginia relinquished her claims in 1784, and three years later the Congress of the Confederation enacted the Ordinance of 1787 (q.v.) for the Northwest Territory. In addition to providing for the government of the territory and for its eventual admission into the Union by states, the ordinance excluded slavery forever and guaranteed basic personal rights. In 1800 the Northwest Territory was divided into two parts, the territories of Indiana and Ohio, and William Henry Harrison was appointed governor of Indiana Territory. With the creation of Michigan Territory in 1805 and Illinois Territory in 1809, Indiana was reduced to its present limits. (See also NORTHWEST TERRITORY.)

Meanwhile, beginning in the late 1780's and continuing for seven or eight years, hostility between the Indians and the settlers grew in intensity. Under the leadership of the Miami chief Little Turtle the Miami and other tribes united against the white men. After defeating militia, first under Brig. Gen. Josiah Harmar (1790) and then under Maj. Gen. Arthur St. Clair (1790), Little Turtle himself met defeat in 1794 in the Battle of Fallen Timbers (see *FALLEN TIMBERS, BATTLE OF*) at the hands of an army led by Maj. Gen. Anthony Wayne. By the Treaty of Greenville (see *GREENVILLE, TREATY OF*) in the following year the Indians ceded a small strip along the eastern side of Indiana as well as most of Ohio to the whites. While additional pioneers moved to Indiana, there was peace for almost 15 years between the whites and the Indians, and Governor Harrison was successful in obtaining the cession of most of southern Indiana and southern Illinois. Tecumseh, a Shawnee chief, then warned that further cessions would mean war and set about forming a confederation of Indian tribes. On Nov. 7, 1811, Harrison defeated the Indians in the Battle of Tippecanoe (see *TIPPECANOE, BATTLE OF*), 7 miles north of where Lafayette now stands. This last major Indian battle in Indiana was followed in the autumn of 1812 by the last big Indian massacre of whites, which took place at Pigeon Roost in the southern part of the territory. Subsequently the Miami and other tribes sold the rest of their lands in Indiana and moved west of the Mississippi. By 1838, when the last of the Potawatomi left the state, only a few Miami remained.

The close of the War of 1812 and the Indian wars which were a phase of it coincided with the end of Indiana's territorial period. A state constitution was drafted in June 1816 at Corydon, and Indiana was admitted to the Union on December 11 of that year. In 1813 the territorial capital had been moved from Vincennes to Corydon, which remained the state capital until 1825, when the seat of government was removed to the new town of Indianapolis.

As settlers swarmed into Indiana—by 1830 the state had a population of 343,031, and by 1840, 685,866—its development was marked by the

flowering and failure of two attempts at communal colonization which attracted wide attention. The first began in 1815, when George Rapp, patriarchal leader of a group of people known as Rappites, and his followers came from Pennsylvania to establish on the Wabash a model community which they called Harmonie. All property was held in common. In 1825, Rapp sold the community to Robert Owen of Scotland, who renamed it New Harmony (q.v.). Owen and his followers continued the practice of common ownership of property, but dissension broke out. Acknowledging defeat, Owen left for England in May 1827, and the experiment came to an end in 1828. Although the communal experiment failed, New Harmony made important contributions to the movement for equal social and legal rights for women and to progressive education.

River transportation, never very successful, was supplemented by winding roads hewed out of the forests. As farmers sought wider markets for their products, these became inadequate, and in the early 1830's the state, with borrowed funds, began the construction of canals. The most important was the Indiana segment of the Wabash and Erie Canal, which was opened between Lafayette and Toledo in 1843. An internal improvement program embracing more than 1,000 miles of roads and canals was begun in 1836, but met with disaster because of extravagance, poor planning, and the panic of 1837. The heavy debt which burdened the young, struggling state as a result of attempting to underwrite these acute growing pains contributed in part to a provision of the 1851 constitution that prohibits the state from incurring indebtedness. Gradually, however, Indiana became more prosperous. Schools and colleges were built, and wood and brick houses replaced the earlier log cabins. Mines and quarries were active, and factories were constructed. In 1854 the Monon Railroad was completed between New Albany and Michigan City. In politics, Indiana remained Democratic until 1837, when a Whig was elected governor. After a short period of Whig popularity the Democrats resumed control until 1861, when the first Republican governor took office.

Many Indianans had come originally from the South, and some of them sympathized with the Confederacy when the Civil War broke out. The majority, however, loyally supported the Union, and under the energetic leadership of Governor Oliver P. Morton, Indiana supplied 208,367 men to the Union cause from a population (1860) of 1,350,428. Although no decisive battles took place on Indiana soil, there were some raids, the most daring being that of Brig. Gen. John Hunt Morgan, who in 1863 swept through Corydon, Salem, Dupont, and Versailles before being captured in Ohio (see also *MORGAN'S RAIDS INTO INDIANA AND OHIO*). A hostile legislature elected in 1862 refused for two years to pass any appropriation bills, and Governor Morton was forced to borrow money on his own credit to finance military operations. Of Indiana's Civil War soldiers and sailors, 26,672 died in battle or from disease.

After the war new factories were built, and roads and railroads were constructed. Agriculture suffered from low crop prices, however, and many farmers and workingmen supported the Greenback and Populist movements. Conditions improved in the early years of the 20th century with the establishment of automobile factories

at Indianapolis and of iron and steel mills in the Calumet region.

In World War I, Indiana furnished 130,670 men to the armed forces, of whom 3,354 died in service, and the state also supplied large quantities of war materials and food. Agriculture enjoyed a boom during the war, but the farmers suffered severely from the postwar collapse in crop prices. Industry remained prosperous until 1929, however, and many new roads and other facilities were built during this period. Both industry and agriculture were hard hit by the depression, but by the late 1930's recovery was well under way, and in World War II Indiana farms and factories made an impressive contribution to the war effort. Over 400,000 Indiana men and women entered the armed services; more than 10,000 lost their lives. Indiana shared in the nation's prosperity after the war, and many new industries were established in the state. New schools and highways were constructed, and the facilities of the colleges and universities were greatly expanded.

After 1861 political control in Indiana was fairly evenly divided between the two major parties, and by 1962 the state had had an equal number of Republican and Democratic governors. In 1940, Wendell L. Willkie, native-son Republican presidential nominee, carried Indiana in his unsuccessful race against Franklin D. Roosevelt, who had won pluralities in the state in 1932 and 1936. From the World War II era into the early 1960's, Republicans dominated the Indiana General Assembly and elected a majority of their Congressional candidates. Thomas E. Dewey (in 1944 and 1948), Dwight D. Eisenhower (in 1952 and 1956) and Richard M. Nixon (in 1960), all Republicans, won Indiana's 13 electoral votes in their bids for the presidency.

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INDIANA, borough, Pennsylvania, seat of Indiana County, situated at an altitude of 1,310 feet, 45 miles east-northeast of Pittsburgh. It has freight service via the Baltimore & Ohio and the Pennsylvania railroads. There are bituminous coal mines nearby. The borough is the seat of a state teachers college founded in 1875, and it has plants producing rubber tires, glass furniture, leather goods, sportswear, clay products, concrete blocks, thermostat controls, macaroni, and beverages. Laid out in 1805, Indiana was incorporated in 1816 and is governed by a borough manager. Pop. 13,005.

INDIANA CENTRAL COLLEGE, a co-educational liberal arts college, opened in 1905, affiliated with the Evangelical United Brethren Church. Bachelor of arts and science (education, business) degrees are granted.

INDIANA UNIVERSITY, a state-supported coeducational institution of higher education located principally at Bloomington, Ind. Opened as a state seminary in 1824, it became a college in 1828 and a university in 1838. It is governed by an eight-member Board of Trustees. On the main campus at Bloomington, which covers 1,395 acres, are located the College of Arts and Sciences, the School of Law, the School of Education, the School of Music, the School of Business, the School of Health, Physical Education, and Recreation, the Graduate School, the Division of Optometry, and the Division of Adult Education and Public Services. There is also a Junior Division, which is concerned with the needs of freshman students. On a 75-acre campus in Indianapolis are the School of Medicine, the School of Dentistry, the School of Law (Evening Division), the Training School for Nurses, the Normal College of the American Gymnastic Union, and divisions of Medical Technology, Graduate Dietetics, and X-Ray Technology. There are adult education centers at East Chicago, Fort Wayne, Gary, Indianapolis, Jeffersonville, Kokomo, Richmond, South Bend, and Vincennes. The university publishes the *Indiana Magazine of History* and a number of scholarly journals. The library contains approximately 1,000,000 volumes, including special collections in American history.

INDIANAPOLIS, in-dī-ān-āp'ō-līs, city, Indiana, capital of the state and seat of Marion County, located on the West Fork of the White River, 184 miles southeast of Chicago. Situated in the center of the state at a focal point of industry, commerce, banking, and trade, the city covers a flat terrain (710 feet above sea level) of 55.2 square miles. The town of Woodruff Place is entirely within city limits but has never been annexed. The temperature of Indianapolis averages 28.8° F. in January and 76.0° F. in July. The business district lies in the heart of the city. Scattered about it are public buildings, the Union Station, and the World War Memorial Plaza, which covers five blocks. In general, the residential section is on the north and east sides; the industrial, on the south and west. In 1950, Indianapolis had 134,654 dwelling units, of which 52.8 per cent were owner occupied.

Industries.—In 1954 the Indianapolis standard metropolitan area had 998 industrial establishments employing 75,953 persons; their combined value added by manufacture was \$594,503,000. Among the largest of the factories are those producing telephone sets, inner tubes, saws, engines, television sets, phonograph records, truck bodies, food products, and gloves. The city's stockyards, opened in 1877, cover 210 acres and are the largest east of Chicago. In 1954 there were 4,632 retail establishments, 1,179 wholesale establishments, and 2,554 service establishments in the city.

Transportation and Communications.—In 1957, Indianapolis was served by 7 railroad systems, 20 bus companies, 142 motor freight lines, and 7 airlines. The city had five radio stations, three television stations, and three major daily newspapers, the *News*, *Star*, and *Times*.

Government.—Indianapolis is governed by a mayor and a common council of nine members, all elected for four years. The mayor appoints the boards and department heads, and the council fixes their respective salaries. Members of the board of education are elected by popular vote.

Education.—The city's institutions of higher learning include Butler University, Indiana Central College, Marian College, Indiana University's schools of medicine, dentistry, and law; and extension schools of Indiana and Purdue universities. The city has both public and parochial high schools and elementary schools, as well as kindergartens and special schools, including state schools for the blind and deaf.

Cultural and Recreational Facilities.—In 1950, the Indianapolis Public Library had about 750,000 volumes and 97,015 registered borrowers; the Indiana State Library had 263,830 volumes, mostly nonfiction, including a collection in Braille and the largest existing collection of material about Indiana. Among the city's other facilities are the John Herron Art Institute (and Museum), the Arthur Jordan College of Music, and a children's museum. The city had 32 parks in 1950 covering 3,234 acres, and also 40 playgrounds. It had six city-owned and nine private golf courses, two midget auto racing tracks; American Association Baseball grounds; an arena for ice hockey matches and track for harness racing; and Butler Field House in which state-wide high school basketball tournaments are held annually. The Indianapolis Motor Speedway is the scene of the world-famous annual 500-mile Memorial Day auto race.

Other Points of Interest.—The city is the headquarters of the American Legion, the International Brotherhood of Teamsters, and 50 other nation-wide organizations. In the heart of the city is the Soldiers and Sailors Monument, completed in 1901 as the second highest monument in the United States (285 feet). In the city are more than 500 places of worship, representing all denominations.

History.—Almost four years after Indiana became a state, commissioners approved (June 7, 1820) a place at the confluence of Fall Creek and White River as the site for the state's capital. By Jan. 8, 1825, when the legislature first met in Indianapolis, the capital and county seat of newly-organized Marion County had 600 inhabitants, a brick courthouse, several taverns, a newspaper, and other evidences of growth, though it was not incorporated as a town until 1836. Meanwhile, in 1830, the National Road (later U.S. 40) was extended through the town. In 1847, Indianapolis was incorporated as a city (population, 8,091), and the Madison Railroad was completed giving it an outlet to the Ohio River. The city now began to develop rapidly as an industrial and marketing center, and a hub of the state's overland transportation system. In 1860, the population was 18,611; by 1870, it had risen to 48,244. Three developments of the 1880's and 1890's made for even more rapid expansion: the discovery near Indianapolis of cheap fuel (natural gas) for industry; an interurban trolley system; and the birth of the automobile industry.

Federal census figures show the steady growth of the population: 105,436 in 1890; 233,650 in 1910; 364,161 in 1930; 427,173 in 1950; and 476,258 in 1960.

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INDIANAPOLIS SYMPHONY ORCHESTRA, founded in 1930 as a cooperative organization. It was conducted by Ferdinand Schaeffer until 1936, when Fabien Sevitzky and Vladimir Bakaleinikoff were engaged as guest conductors. The orchestra was then reorganized on a permanent basis and financial management was put in the hands of the Indiana State Symphony Society. Sevitzky was appointed permanent conductor and has held the position since 1937. Eleven pairs of subscription concerts are given each season in the Murat Theatre as well as popular concerts and children's concerts.

INDIANOLA, city, Mississippi, county seat of Sunflower County; altitude 127.4 feet; on the Columbus and Greenville Railroad; 101 miles north of Jackson. Near the center of the fertile Yazoo-Mississippi delta area, it is an agricultural and trading center. Formerly called Indian Bayou, the name was changed to the present in honor of the Indian maid, Ola, and was incorporated in 1886. It has mayor and council government. Pop. 6,714.

INDIANS, American. Christopher Columbus, sailing for the Indies, found instead the New World of the Western Hemisphere and called the native people Indians. This discovery, in 1492, and the centuries of exploration, conquest and settlement which followed revealed to the Europeans a world new in many ways. By the early 19th century the final contact between Europeans and a native group had taken place. Little by little, during recent years, the story of the American Indians and their ways of life in the past and present has been unfolded. But what would Columbus and his companions have seen if their's had been a bird's-eye view of the whole New World and its inhabitants?

By the 15th century the Indians were living in all parts of North, Central, and South America, from the Arctic Ocean to Tierra del Fuego and from the Atlantic Ocean to the Pacific. At that time the Indians probably numbered over thirteen million. Out of this total, about one million lived north of the Rio Grande, over three million lived in Middle America, and about 9 million lived in South America. To European eyes first seeing them, all American Indians looked much alike physically because of their hair and skin color. Actually, in other respects, there has always been some variation in physical type among the American Indians. In head shape, nose form, and bodily height the Indians would have revealed to the early discoverers their physical diversity.

The American Indian languages would have shown an even greater diversity to the Europeans. North and South America together contained more linguistic families than all the rest of the world. Forty different linguistic stocks were represented in North and Middle America and another 40 in South America. At the time of discovery the number of people speaking these different languages varied enormously. Some languages were spoken by only a few hundred people,

while others were spoken by many people spread over large areas. A 15th century bird's-eye view of the New World would have shown an equally amazing variation in the way in which the Indians lived. In several parts of the New World, the European explorers found well-established, complex civilizations with a developed political, economic, religious, and artistic life. Between these peaks of development they found groups following different and simpler ways of life. They found groups living in settled towns and villages with an economy based on intensive farming, hunting or fishing. They also found people leading a simple nomadic life following wild game and gathering wild food. In some areas they found people living in substantial houses of stone or mudbrick near huge palaces, temples or fortresses. Elsewhere the dwellings were simple brush or skin shelters. The Europeans encountered complex, integrated state organizations with class stratification on the one hand and simple band organization on the other.

Sources of Information on the American Indian.—This glimpse of the diversity of physical type, language and way of life suggests a long and complex history for the American Indian prior to the 15th century. What is known of the time and place of origin of these Indians? What is known of the development of their ways of life and how do we find the answers to any of these questions? These topics have long been a favorite subject for speculation as well as for careful study. Most of the speculations about the origin and development of American Indian life have been based on completely superficial observations. Chance similarities between Egyptian civilization and the Maya Indians of Central America, for example, have lead some people to assume a close connection between these two groups. To make this connection practical some people have revived the legend of the lost continent of Atlantis. This same kind of speculation has lead to similar mistaken conclusions about other groups and other lost continents.

What are the careful and valid sources of information on these questions about the American Indians? Most of this information comes from studies made by anthropologists. They, with much help from historians, geologists, paleontologists, and specialists in other fields, have been piecing together the long story of the American Indians. From different specialists within the field of anthropology come the various parts of this story. The physical anthropologists study the skeletal material of the early Indians and the physical characteristics of the living Indians including blood-group affiliation which seems to have some racial significance. From the physical anthropologist comes our information about the racial affiliation of the American Indians. From the anthropologists who specialize in linguistic studies and who compare Indian languages and reconstruct the earlier types comes the story of the Indian languages. Other important sources of information are the anthropologists who specialize in archaeology and in ethnology. By careful excavation the archaeologist uncovers the remains of the prehistoric Indians. This includes skeletal remains, and such material evidence of pottery, houses, weapons and other equipment as survive. From this the archaeologist carefully reconstructs the early history of the Indians.

The ethnologist, by a study of historical docu-

ments and a comparison of living and recent Indian groups adds to the picture.

To complete their work in reconstructing the story of the American Indian, anthropologists receive the help of the paleontologists and geologists in establishing relative dates and time perspective. With the help of the botanists they have worked out the story of such an important native American plant as corn. And very valuable assistance has come from the work of radiation chemists in determining more specific dates for early prehistoric material. The methods and results of this work may still be subject to some modification, but they are now widely accepted. The findings are referred to as "Carbon 14" dates. New evidence is constantly being added to the study of the American Indian, and new interpretations of old evidence are sometimes necessary. But on the broad outlines and the major developments and time sequences in the story there is general agreement.

Peopling of the New World.—It seems certain that the American Indians did not originate in the New World but gradually migrated from Asia sometime after the end of the Ice Age. There is a variety of evidence to support this conclusion. To begin with, no archaeologist has found any human skeletal remains of an extremely early date or of a physical type significantly different from modern Indian types. Some tools, presumably man-made, have been found closely associated with extinct animal bones. But, unlike the situation in other parts of the world, the extinction of these animals was relatively recent in the New World. This absence of early human material is consistent with another line of evidence. Because there are no living anthropoid apes in the New World, and no fossil remains of extinct apes have been found, it seems most unlikely that early man could have evolved there.

Where, then, did the American Indian come from? In his most stable and most characteristic physical traits, the American Indian is like the Mongoloid stock found in most of Asia. They share blue-black color and straight, coarse quality of hair; generally dark skin color; and shovel-shaped incisor teeth. This does not, of course, equate the American Indian and the modern Chinese. It means, rather, that at some time in the past, a group of Mongoloid stock separated from the main group in Asia. After reaching the New World they probably had little or no contact with the main Mongoloid stock and developed certain characteristics of their own. The one New World group most similar to the Asiatic Mongoloids are the Eskimos. They, along with the tribes living in northeastern Asia, are classified as the Arctic Mongoloid race, a division of the Primary Mongoloid stock. All other New World aborigines are classified in the division of the composite Mongoloid stock called American Indian race.

The non-Mongoloid physical characteristics of the American Indians are the unspecialized ones which some authorities have classified as indicating an ancient "white" admixture to the predominantly Mongoloid base. Such a mixture might have occurred in some Indian groups before they left Asia, or they might represent a parental form like the modern whites or Mongoloids but less specialized than either of them. One important difference existed in the setting of the Asiatic and New World groups. The Asiatic Mongoloids were in touch with other racial

INDIAN RESERVATIONS IN THE UNITED STATES

The statistics making up this list were compiled from a variety of federal and private sources, and were carefully summarized to achieve the most accurate estimate possible, in view of the paucity of data. No truly reliable population count of the American Indian has ever been compiled, but it is believed that this table will prove to be as close to reality as can presently be made. Many of these counts were obtained from agency personnel, in substantiation of Bureau of Indian Affairs figures.

Two points should be made clear to users of this listing: (1) It cannot be used to arrive at a total Indian population, since it does not include off-reservation Indians, and (2) the count regards as "Indian" those people enrolled upon tribal lists, those individuals of one quarter or more Indian blood who are included in Bureau of Indian Affairs counts, and those individuals living on reservations and identifying as Indian.

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<i>Reservation</i>	<i>Tribe</i>	<i>State</i>	<i>Popu- lation (1956 est.)</i>	<i>Area in acres</i>	<i>Date estab- lished</i>
Acoma Pueblo	Acoma	New Mexico	1,888	233,930	1689
Agua Caliente: <i>see</i> Palm Springs					
Ak Chin: <i>see</i> Maricopa					
Akiak	Eskimo	Alaska	143	1,373	1917
Akutan and Akun	Aleut	Alaska	86	72,000	1943
Alabama-Coushatta	Alabama, Koasati	Texas	415	4,281	1854
Alexander Valley	Wappo	California	49	54	1909
Allegany	Seneca, Onondaga	New York	900	26,880	1797
Allen Canyon	Ute	Utah	29	2,260	1887
Alpine County	Washo	California	132	260	1887
Alturas	Shasta	California	11	20	1922
Amaknak Island		Alaska	Reserved for fishing	110	1933
Anderson Valley: <i>see</i> Redding					
Annette Island: <i>see</i> Metlakatla					
Auberry: <i>see</i> Big Sandy					
Auburn	Maidu	California	82	20	1914
Augustine	Kawia	California	17	616	1893
Bad River (La Pointe)	Chippewa	Wisconsin	1,275	74,752	1854
Barona Rancho: <i>see</i> Capitán Grande					
Battle Mountain	Shoshoni	Nevada	150	680	1917
Bay Mills	Chippewa	Wisconsin	312	2,356	1936
Bear River	Mattole	California	22	15	1911
Beaver Island; Hog Island	Ottawa	Michigan	94	1,749	1935
Benton	Paiute	California	Reserved for cemetery use	160	1915
Big Bend	Shasta	California	10	40	1914
Big Cypress	Seminole	Florida	150	147,463	1938
Big Lagoon	Yurok	California	6	9	1917
Big Pine: <i>see</i> Owens Valley					
Big Sandy (Auberry)	Mono	California	101	280	1909
Big Valley	Pomo	California	124	102	1911
Bishop: <i>see</i> Owens Valley					
Blackfeet	Blackfoot, Piegan, Blood	Montana	7,394	1,197,000	1873
Blue Lake	Hupa, Wiyot	California	65	26	1908
Bois Fort: <i>see</i> Nett Lake					
Brighton	Seminole	Florida	175	36,925	1938
Buena Vista	Miwok	California	5	70	1926
Burns (Harney)	Paiute	Oregon	200	14,519	1934
Cabazon	Kawia	California	28	1,480	1876

<i>Reservation</i>	<i>Tribe</i>	<i>State</i>	<i>Popu- lation (1956 est.)</i>	<i>Area in acres</i>	<i>Date estab- lished</i>
Cache Creek	Pomo	California	9	160	1917
Cahuilla	Kawia	California	93	18,252	1875
Camp Verde	Tonto Apache, Yavapai	Arizona	471	498	1914
Campo	Diegueño	California	125	15,010	1893
Cañoncito	Navaho	New Mexico	428	69,842	1925
Capitán Grande	Diegueño	California	168	21,848	1875
Carson	Washo	Nevada	100	160	1940
Cass Lake: <i>see</i> Greater Leech Lake					
Catawba	Catawba	South Carolina	539	4,270	1763
Cattaraugus	Seneca, Cayuga, Onondaga	New York	2,000	21,760	1797
Cedar City	Paiute	Utah	28	13	1914
Cedarville	Paiute	California	15	17	1906
Celilo (The Dalles)	Yakima, Wasco	Oregon	Reserved for fishing use	Flooded	1947
Chandalar: <i>see</i> Venetie					
Chehalis	Chehalis, Clatsop, Chinook	Washington	120	2,257	1864
Chemehuevi	Chemehuevi	California	1,333	28,000	1907
Cherokee: <i>see</i> Qualla					
Cheyenne-Arapaho	Cheyenne, Arapaho	Oklahoma	3,300	180,560	1869
Cheyenne River	Sioux	South Dakota	4,983	2,812,022	1889
Chicken Ranch: <i>see</i> Jamestown					
Chico	Mixed	California	50	25	1942
Chilkat	Tlingit	Alaska	Reserved for fishing	17	1915
Choctaw	Choctaw	Mississippi	3,136	16,800	1918
Chukchansi (Picayune)	Yokuts	California	25	80	1912
Clam Lake	Chippewa	Wisconsin	10	200	1937
Clear Creek: <i>see</i> Redding					
Cloverdale	Pomo	California	18	28	1917
Cochiti Pueblo	Cochiti	New Mexico	529	25,854	1689
Cocopa	Cocopa	Arizona	78	360	1907
Coeur d'Alene	Coeur d'Alene, Kutenai	Idaho	711	345,000	1867
Cold Springs (Sycamore)	Mono	California	46	160	1914
Colorado River	Mojave, Navaho, Chemehuevi, Hopi	Arizona, California	1,500	242,709	1874
Colusa	Wintun	California	58	255	1908
Colville	Mixed	Washington	4,255	1,362,533	1872
Cornplanter	Seneca	Pennsylvania	30	800	1797
Cortina	Miwok	California	5	640	1908
Coyote Valley	Pomo	California	26	101	1909
Crescent City	Hupa	California	41	100	1909
Crow	Crow	Montana	3,702	2,018,218	1851
Crow Creek	Sioux	South Dakota	1,132	150,000	1863
Cuyapaipe	Diegueño	California	3	5,320	1893
Danbury	Chippewa	Wisconsin	100	129	1935
Dania	Seminole	Florida	120	475	1894
Deer Creek: <i>see</i> Nett Lake					
Devil's Lake: <i>see</i> Fort Totten					
Dresslerville	Washo	Nevada	170	40	1939
Dry Creek	Pomo	California	28		1925
Duck Valley	Shoshoni, Paiute	Nevada/Idaho	966	289,827	1877
Duckwater	Shoshoni	Nevada	127	3,643	1940
Eastern Shawnee	Shawnee	Oklahoma	158	2,782	1867

<i>Reservation</i>	<i>Tribe</i>	<i>State</i>	<i>Popu- lation (1956 est.)</i>	<i>Area in acres</i>	<i>Date estab- lished</i>
Eel River	Miami	California	132		1908
Eklutna	Tanaina	Alaska	60	40	1916
Elim (Norton Bay)	Eskimo	Alaska	154	316,000	1917
Elko	Shoshoni, Paiute	Nevada	122	193	1918
Ely	Shoshoni	Nevada	150	10	1930
Enterprise	Maidu	California	37	81	1914
Etna (Ruffeys)	Mixed	California	10	441	1907
Fallon	Paiute, Shoshoni	Nevada	267	6,560	1902
Flandreau	Sioux	South Dakota	289	2,741	1936
Flathead (Jocko)	Salish, Kutenai	Montana	4,406	632,516	1872
Fond du Lac	Chippewa	Minnesota	1,450	25,394	1889
Forest County	Potawatomi	Wisconsin	364	11,040	1913
Fort Apache	Apache	Arizona	3,950	1,664,872	1871
Fort Belknap	Assiniboin, Gros Ventre	Montana	2,560	664,008	1888
Fort Berthold	Arikara, Mandan, Gros Ventre	North Dakota	3,134	580,498	1870
Fort Bidwell	Paiute	California	99	3,340	1897
Fort Hall	Bannock, Shoshoni	Idaho	2,275	524,878	1868
Fort Independence	Paiute	California	74	320	1915
Fort McDermitt	Paiute	Nevada/Oregon	288	323,804	1912
Fort McDowell	Yavapai	Arizona	210	24,680	1903
Fort Mojave	Mojave	Arizona/California	374	27,592	1880
Fort Peck	Assiniboin, Sioux	Montana	3,881	1,270,301	1886
Fort Totten (Devil's Lake)	Sioux	North Dakota	1,500	52,093	1867
Fort Yukon	Kutchin	Alaska	446	75	1914
Fort Yuma	Yuma, Cocopa	California	1,204	8,743	1884
Fox Island	Ottawa	Michigan		619	1887
Gila Bend	Papago	Arizona	200	10,297	1882
Gila River	Maricopa, Pima	Arizona	5,546	372,022	1883
Goshute	Gosiute	Utah/Nevada	188	109,115	1914
Grand Portage	Chippewa	Minnesota	399	42,805	1889
Grand Ronde	Clackmas, Umpqua	Oregon	2,081	20,504	1857
Granite Falls: <i>see</i> Upper Sioux					
Graton (Sebastopol)	Pomo	California	4	243	1909
Greater Leech Lake	Chippewa	Minnesota	2,403	78,629	1889
Greenville	Maidu	California	40	275	1897
Grindstone Creek	Wintun	California	35	80	1908
Guidiville	Pomo	California	26	243	1909
Harney Valley: <i>see</i> Burns					
Hannahville	Potawatomi	Michigan	145	3,359	1913
Havasupai	Havasupai	Arizona	260	34,439	1880
Hog Island: <i>see</i> Beaver Island					
Hoh River	Yurok, Quinault	Washington	26	433	1893
Hoopa Valley	Hupa, Yurok, Karok	California	1,271	104,800	1864
Hopi	Hopi, Navaho	Arizona	4,834	2,472,216	1882
Hopland	Pomo	California	79	2,070	1908
Hualapai	Hualapai	Arizona	706	997,000	1883
Hydaburg	Haida	Alaska	401	100,000	1949
Inaja-Cosmit	Diegueño	California	30	880	1875
Indian Ranch	Shoshoni	California	5	560	1928
Inyo: <i>see</i> Owens Valley					
Iowa-Potawatomi	Iowa	Kansas/Nebraska	580	1,654	1854
Iowa-Shawnee	Iowa	Oklahoma	114	2,472	1891
Isabella (Saginaw)	Chippewa	Michigan	414	2,323	1855
Isleta Pueblo	Isleta	New Mexico	1,759	209,162	1689

<i>Reservation</i>	<i>Tribe</i>	<i>State</i>	<i>Population</i> (1956 est.)	<i>Area</i> <i>in</i> <i>acres</i>	<i>Date</i> <i>estab-</i> <i>lished</i>
Jackson	Miwok	California	5	330	1893
Jamestown (Chicken Ranch)....	Miwok	California	7	40	1910
Jémez Pueblo	Jémez	New Mexico	1,137	120,027	1689
Jicarilla	Jicarilla Apache	New Mexico	1,175	745,809	1887
Kaibab	Paiute	Arizona	100	120,453	1917
Kalispel	Kalispel	Washington	165	4,629	1914
Kanosh	Ute, Paiute	Utah	42	7,730	1929
Karluk	Aleut	Alaska	144	35,200	1943
Kaw	Kansa (Kaw)	Oklahoma	544	13,261	1902
Keweenaw Bay: <i>see</i> L'Anse					
Kickapoo-Five Tribes	Kickapoo	Oklahoma	283	8,817	1883
Kickapoo-Potawatomi	Kickapoo	Kansas	360	6,399	1862
Kiowa and Comanche	Kiowa, Apache, Comanche	Oklahoma	7,720	380,197	1867
Klamath	Klamath, Modoc, Paiute	Oregon	1,425	1,000,827	1864
Kluckwan	Tlingit	Alaska	95	375	1913
Kobuk	Eskimo	Alaska	233	144,000	1914
Koosharem	Ute, Paiute	Utah	34	440	1928
Kootenai	Kutenai	Idaho	107	4,015	1894
Lac Court Oreilles	Chippewa	Wisconsin	823	41,006	1854
Lac du Flambeau	Chippewa	Wisconsin	1,105	33,426	1854
Laguna	Diegueño	California	5	320	1893
Laguna Pueblo	Laguna	New Mexico	3,475	409,731	1699
La Jolla	Luiseno	California	235	8,329	1892
L'Anse (Keweenaw Bay)	Chippewa	Michigan	1,323	13,813	1854
La Pointe: <i>see</i> Bad River					
La Posta	Diegueño	California	none	3,879	1893
Lapwai (Nez Percé)	Nez Percé	Idaho	2,213	125,000	1894
Las Vegas	Paiute	Nevada	89	10	1911
Laytonville	Pomo, Kato	California	83	200	1907
Likely	Achomawi	California	59	40	1922
Little Diomed Island	Eskimo	Alaska	126	3,200	1946
Lone Pine: <i>see</i> Owens Valley					
Lookout	Achomawi	California	50	50	1913
Los Coyotes	Diegueño	California	91	25,050	1900
Lovelock	Paiute	Nevada	135	20	1910
Lower Brulé	Sioux	South Dakota	705	205,356	1889
Lower Elwha	Quillayute	Washington	134	372	1938
Lower Sioux (Morton)	Sioux	Minnesota	230	1,743	1938
Lummi	Lummi	Washington	830	10,164	1873
Lytton	Pomo	California	8	50	1927
Makah	Makah, Quillayute	Washington	544	27,075	1855
Manchester: <i>see</i> Point Arena					
Manzanita	Diegueno	California	63	3,520	1893
Maricopa (Ak Chin)	Papago	Arizona	139	21,840	1916
Mark West	Pomo	California	1	35	1909
Mattapony	Mattapony	Virginia	150	50	1658
Menomini	Menomini	Wisconsin	3,270	233,902	1854
Mesa Grande	Diegueño	California	241	5,963	1875
Mescalero	Mescalero Apache	New Mexico	1,050	460,177	1864
Metlakatla (Annette Island)....	Tsimshian	Alaska	795	86,741	1916
Miami	Miami	Oklahoma	305	12,878	1867
Middletown	Pomo	California	26	109	1909
Mille Lac	Chippewa	Minnesota	453	3,393	1914
Mission Creek	Kawia	California	20	2,560	1921

<i>Reservation</i>	<i>Tribe</i>	<i>State</i>	<i>Popu- lation (1956 est.)</i>	<i>Area in acres</i>	<i>Date estab- lished</i>
Moapa River	Paiute	Nevada	176	1,174	1873
Modoc County	Paiute, Achomawi	California	318	8,760	1945
Mole Lake: <i>see</i> Sakaogon					
Mono County	Paiute, Washo	California	439	422	1929
Montauk	Montauk	New York	30		1650
Montgomery Creek	Achomawi	California	3	2,560	1914
Moquakie: <i>see</i> Tyonek					
Morongo	Serrano	California	316	31,723	1877
Morton: <i>see</i> Lower Sioux					
Mountain Village	Eskimo	Alaska	253	1,280	1917
Muckleshoot	Muckleshoot	Washington	300	2,775	1857
Munsee: <i>see</i> Stockbridge					
Nambé Pueblo	Nambé	New Mexico	184	18,791	1689
Navaho	Navaho (Navajo)	Arizona, New Mexico	84,000	15,444,952	1868
Nett Lake (Bois Fort)	Chippewa	Minnesota	809	79,258	1889
Nevada City	Maidu	California	12	75	1913
Niobrara (Santee Sioux)	Sioux	Nebraska	1,372	6,951	1866
Nisqually	Nisqualli	Washington	62	1,111	1857
North Fork	Mono	California	7	80	1914
Northern Cheyenne: <i>see</i> Tongue River					
Norton Bay: <i>see</i> Elim					
Omaha	Omaha	Nebraska	1,698	29,758	1854
Oneida	Oneida	New York	346	380	1794
Oneida (Tomah)	Oneida	Wisconsin	3,473	5,000	1838
Onondaga	Onondaga, Cayuga, Oneida	New York	900	6,100	1794
Ontonagon	Chippewa	Michigan	35	765	1854
Osage	Osage	Oklahoma	6,094	1,470,559	1872
Oto	Oto	Oklahoma	1,046	45,085	1880
Ottawa	Ottawa	Oklahoma	488	15,771	1867
Ouray: <i>see</i> Uintah					
Owens Valley	Paiute, Shoshoni	California	407	1,391	1912
Ozette	Nootka, Makah	Washington	none	719	1893
Paiute (Indian Peak)	Paiute	Utah	17	10,240	1915
Pala	Luisiño	California	223	20,495	1902
Palm Springs (Agua Caliente) ..	Kawia	California	74	31,128	1876
Pamunkey	Pamunkey	Virginia	300	800	1642
Papago: <i>see</i> Sells					
Passamaquoddy	Passamaquoddy	Maine	500		1795
Paugusett (Golden Hill)		Connecticut			1650
Pauma (Yuima)	Luisiño	California	66	250	1893
Pawnee	Pawnee	Oklahoma	1,507	37,434	1887
Pechanga (Temécula)	Luisiño	California	211	4,125	1893
Penobscot	Penobscot	Maine	580	4,481	1818
Peoria and Miami	Peoria, Miami, Kaskaskia, Wea	Oklahoma	762	30,455	1867
Picurís Pueblo	Picurís	New Mexico	138	41,687	1689
Pine Ridge	Sioux	South Dakota	9,875	2,072,308	1889
Pinoleville (Ukiah)	Pomo	California	70	97	1911
Pipestone	Sioux	Minnesota	109	532	1886
Point Arena (Manchester)	Pomo	California	123	360	1908
Pojoaque	Pojoaque	New Mexico	29	41,126	1689
Ponca	Ponca	Nebraska	441	3,641	1858
Ponca	Ponca	Oklahoma	926	36,919	1887
Poosepatuck	Poosepatuck	New York	60	50	1666

<i>Reservation</i>	<i>Tribe</i>	<i>State</i>	<i>Popu- lation (1956 est.)</i>	<i>Area in acres</i>	<i>Date estab- lished</i>
Port Gamble	Clallam	Washington	130	1,231	1938
Port Madison	Suquamish	Washington	79	4,309	1855
Potawatomi	Potawatomi	Kansas	1,300	27,000	1861
Potawatomi	Potawatomi, Shawnee	Oklahoma	2,976	5,973	1867
Potter Valley	Pomo	California	15	96	1909
Prairie Island	Sioux	Minnesota	111	653	1937
Prior Lake	Sioux	Minnesota	21	110	1935
Puertocito	Navaho	New Mexico	388	62,000	1931
Puyallup	Puyallup	Washington	479	35	1854
Pyramid Lake	Paiute	Nevada	603	475,162	1874
Qualla (Cherokee)	Cherokee	North Carolina	4,266	56,115	1907
Quapaw	Quapaw	Oklahoma	720	56,853	1883
Quartz Valley	Shasta, Karok, Klamath	California	120	604	1937
Quillayute	Quillayute	Washington	281	837	1889
Quinault	Quinault, Quillayute, Chinook	Washington	520	174,920	1855
Ramah	Navaho	New Mexico	789	91,456	1931
Ramona		California	none	520	1893
Red Cliff	Chippewa	Wisconsin	653	8,859	1854
Red Lake	Chippewa	Minnesota	2,923	573,238	1863
Redding (Clear Creek)	Mixed	California	30	30	1922
Redwood Valley	Pomo	California	37	80	
Reno-Sparks	Paiute, Washo	Nevada	231	28	1917
Resighini	Yurok	California	28	228	1939
Rincón	Luiseno	California	191	3,486	1892
Robinson (East Lake)	Pomo	California	47	88	1909
Rocky Boy	Chippewa, Cree	Montana	1,396	104,693	1916
Rohnerville	Mattole	California	31	15	1932
Rosebud	Sioux	South Dakota	8,189	1,135,314	1889
Round Lake	Chippewa	Wisconsin	34	421	1935
Round Valley	Wintun, Maidu, Wailaki	California	802	25,654	1864
Ruby Valley	Shoshoni	Nevada	65	1,240	1940
Ruffeys: <i>see</i> Etna					
Rumsey	Wintun	California	20	141	1908
Sac and Fox	Sac-Fox, Winnebago, Potawatomi	Iowa	504	3,253	1857
Sac and Fox	Sac-Fox	Kansas/Nebraska	140	865	1854
Sac and Fox	Sac-Fox	Oklahoma/Arkansas	1,409	26,351	1891
Saint Croix	Chippewa	Wisconsin	457	1,614	1935
St. Lawrence Island		Alaska	Reindeer reserve	1,705,000	1903
St. Regis Mohawk	Mohawk	New York	1,866	16,640	1796
Sakaogon (Mole Lake)	Chippewa	Wisconsin	205	1,680	1939
Salt River	Pima, Maricopa	Arizona	1,403	46,627	1879
San Carlos	Apache	Arizona	4,544	1,643,939	1872
San Felipe Pueblo	San Felipe	New Mexico	971	47,788	1689
San Ildefonso Pueblo	San Ildefonso	New Mexico	229	26,079	1689
San Juan Pueblo	San Juan	New Mexico	934	20,601	1689
San Manuel	Luiseno	California	49	653	1893
San Pasqual	Mission	California	9	1,343	1910
San Xavier	Papago	Arizona	600	71,090	1874
Sand Lake	Chippewa	Wisconsin	47	446	1939
Sandía Pueblo	Sandía	New Mexico	306	22,885	1748
Santa Ana Pueblo	Santa Ana	New Mexico	353	42,172	1689

<i>Reservation</i>	<i>Tribe</i>	<i>State</i>	<i>Popu- lation (1956 est.)</i>	<i>Area in acres</i>	<i>Date estab- lished</i>
Santa Clara Pueblo	Santa Clara	New Mexico	669	45,746	1689
Santa Rosa	Kawia	California	53	11,093	1907
Santa Ynez	Chumash	California	87	99	1901
Santa Ysabel	Diegueño	California	279	9,679	1893
Santee Sioux: <i>see</i> Niobrara					
Santo Domingo Pueblo	Santo Domingo	New Mexico	1,455	69,277	1689
Schaghticoke		Connecticut	6	400	1735?
Scotts Valley	Pomo	California	27	57	1909
Sebastopol: <i>see</i> Graton					
Sells	Papago	Arizona	8,688	2,773,894	1917
Seminole	Seminole	Florida	945	264,925	1936
Seneca-Cayuga	Seneca, Cayuga	Oklahoma	930	6,972	1867
Shawnee	Shawnee, Seneca	Oklahoma	712	20,735	1875
Shinnecock	Shinnecock	New York	150	400	1700
Shivwits	Paiute	Utah	130	28,160	1916
Shoalwater	Chehalis	Washington	28	335	1866
Siletz	Mixed	Oregon	685	8,490	1855
Sisseton	Sioux	South and North Dakota	3,672	311,108	1867
Skokomish	Skokomish, Twana Clallam	Washington	230	3,052	1855
Skull Valley	Gosiute	Utah	41	19,665	1912
Smith River	Tolowa	California	113	163	1912
Soboba	Luiseño	California	137	5,116	1913
South Fork: <i>see</i> Te-Moak					
Southern Ute	Ute	Colorado	569	309,548	1868
Spokane	Spokane	Washington	1,239	137,689	1881
Squaxin	Squaxin, Puyallup, Nisqualli	Washington	300	1,226	1855
Standing Rock	Sioux, Blackfoot	South and North Dakota	4,324	1,072,804	1889
Stewart's Point	Pomo	California	112	40	1916
Stockbridge (Munsee)	Stockbridge, Munsee	Wisconsin	501	13,300	1856
Summit Lake	Paiute	Nevada	48	10,208	1913
Swinomish	Swinomish	Washington	216	5,622	1825
Sycuan	Diegueño	California	37	604	1875
Table Bluff	Miami	California	66	20	1914
Taos Pueblo	Taos	New Mexico	1,137	47,342	1689
Tatitlek	Eskimo	Alaska	89	480	1917
Te-Moak (South Fork)	Paiute, Shoshoni	Nevada	140	13,050	1941
Temecula: <i>see</i> Pechanga					
Tesuque Pueblo	Tesuque	New Mexico	185	17,027	1689
Tetlin	Nabesna	Alaska	73	768,000	1930
The Dalles: <i>see</i> Celilo					
Tonawanda	Seneca, Cayuga	New York	628	7,549	1797
Tongue River (Northern Cheyenne)	Cheyenne	Montana	2,165	444,157	1884
Tonkawa (Oakland)	Tonkawa	Oklahoma	64	2,579	1887
Torres-Martínez	Kawia	California	202	30,132	1909
Trinidad	Yurok	California	12	59	1907
Tulalip	Snohomish	Washington	765	22,409	1873
Tule River	Mono, Yokuts	California	205	54,116	1873
Tuolumne	Miwok	California	55	312	1912
Turtle Mountain	Chippewa	North Dakota	8,000	71,272	1882
Tuscarora	Tuscarora, Onondaga	New York	430	6,249	1838
Twenty-Nine Palms	Serrano	California	none	161	1895

<i>Reservation</i>	<i>Tribe</i>	<i>State</i>	<i>Population</i> (1956 est.)	<i>Area</i> <i>in</i> <i>acres</i>	<i>Date</i> <i>estab-</i> <i>lished</i>
Tyonek (Moquakie)	Tanaina	Alaska	132	26,918	1915
Uintah and Ouray	Ute	Utah	1,625	1,061,673	1861
Ukiah: <i>see</i> Pinoleville					
Umatilla	Walla Walla, Umatilla, Cayuse	Oregon	1,251	107,300	1855
Unalakleet	Eskimo	Alaska	396	870	1941
Uncompahgre	Ute	Utah	500	633,907	1882
Upper Lake	Pomo	California	81	562	1908
Upper Sioux (Granite Falls)....	Sioux	Minnesota	104	738	1938
Ute Mountain	Ute	Colorado, Utah, New Mexico	675	533,886	1868
Venetie (Chandalar)	Kutchin	Alaska	81	1,408	1943
Vermillion: <i>see</i> Nett Lake					
Viejas: <i>see</i> Capitán Grande					
Wales	Eskimo	Alaska	141	212,000	1943
Walker River	Paiute, Shoshoni	Nevada	500	320,420	1874
Warm Springs	Tenino, Wasco, Paiute	Oregon	1,250	563,041	1855
Washakie	Shoshoni	Utah	136		1935
Washo	Washo	Nevada	259	65,726	1916
Wells	Shoshoni	Nevada	52		
White Earth	Chippewa	Minnesota	9,390	633,076	1889
White Mountain	Eskimo	Alaska	158	1,200	1925
Wichita	Caddo, Tawakoni, Delaware, Wichita	Oklahoma	1,809	102,604	1866
Wilton	Miwok	California	40	39	1927
Wind River	Arapaho, Shoshoni	Wyoming	3,817	2,170,000	1868
Winnebago	Winnebago	Nebraska	1,586	33,648	1865
Winnemucca	Paiute	Nevada	40	340	1871
Winnebigoishish: <i>see</i> Greater Leech Lake					
Wyandot	Wyandot	Oklahoma	894	2,934	1867
XL Ranch	Achomawi	California	33	8,760	1906
Yakima	Yakima, Klikitat	Washington	4,442	1,149,362	1855
Yankton	Sioux	South Dakota	2,391	44,938	1858
Yavapai	Yavapai	Arizona	75	71	1935
Yendistucky	Tlingit	Alaska	357	143	1916
Yerington	Paiute	Nevada	460	1,156	1936
Yomba (Rees River)	Shoshoni	Nevada	156	4,681	1938
Zia Pueblo	Zia [Keres]	New Mexico	327	146,096	1689
Zuñi Pueblo	Zuñi	New Mexico	3,439	400,840	1877

The Indian Reservations listed above are presented with the spellings as they appear on the United States government records; locally-used variants are given in parenthesis. It will be noted that some of these reservations are no longer inhabited; these are retained as open land for tribal use in observance of existing agreements. As a few have been withdrawn, and with the normal pulse of politics and population growth, it is to be expected that population statistics and land acreages will change almost annually. Many of these reservations, most notably in New York, are now under state rather than federal jurisdiction; no indication is made of such administrative variation.



Blood Indian girl: "Many Snake Woman."



Three generations in a Cree Indian family.



A blind Paiute Indian.

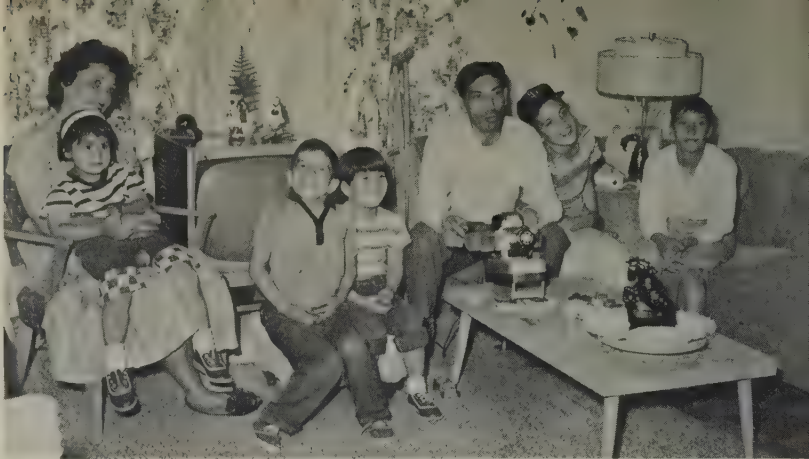


Sioux Indian girl: "Rattling Day Woman."

AMERICAN INDIANS

Portraits painted from life by Winold Reiss

Right: Indian family in their new home in San Francisco. The Bureau of Indian Affairs has helped many Indians find jobs in urban areas.



All photographs: Bureau of Indian Affairs

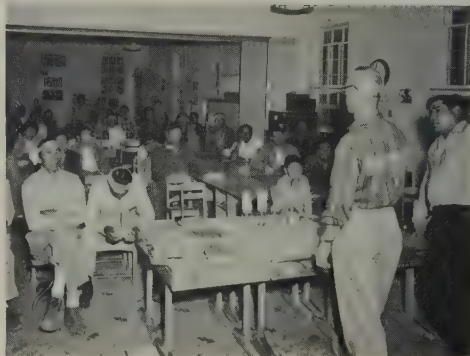
AMERICAN INDIANS

Left: Vincent Myers, Comanche Indian of Apache, Okla., at work on his 160-acre farm. A veteran of World War II, during which he rose to the rank of major and won the Distinguished Flying Cross and the Air Medal, Myers was the winner of the Department of Interior's Conservation Award for 1960.



Right: Indians at San Felipe Pueblo Reservation in New Mexico attend a lecture on soil control, as part of the bureau's technical aid program. The over-all goal is to conserve soil and increase crop production.

Left: Adult education class for Seminoles at the Big Cypress Reservation in Florida. In cooperation with tribal governing bodies, the bureau has established adult education teaching units in over 100 Indian communities.



strains, whereas those coming to the New World entered a free territory. One of the most interesting and puzzling differences between the Asiatic Mongoloids and the American Indians is that of blood group affiliation. The American Indian, in general, is very high in group O affiliation and very low in A, whereas O and A are of nearly equal frequency among the Mongoloids. It is possible that this variation occurred in the course of the original adaptation to the New World environment.

A matter which has received considerable attention in discussions of physical characteristics of American Indians is the apparent gradual change from an early, long-headed type to a later, round-headed type. A factor which makes it difficult to assess this difference is the practice of head deformation which was widespread in the New World, and which precludes the accurate measurement of many skeletal remains and living peoples. The question has been raised whether this change, if real, indicates additional migration into the New World or a local development. It should be noted that this same shift has been characteristic of peoples all over the world. Despite this possible variation in head shape, some regional differences in stature and in some minor physical characteristics, the American Indian shows relatively little physical variability. There is, in fact, less variation in the New World than in any comparable area of the Old World.

There is little doubt about the route which these early migrants took from Asia to North America. The two continents are close only at the Bering Strait, where they are about 60 miles apart. At an earlier time this distance was probably shorter, the crossing even easier. When the strait is frozen, it is possible even now to make the crossing on foot. It seems likely that groups of Asian hunters and fishermen, following the game, moved gradually across this area. Finding the climate and the food supply suitable they moved on, not knowing, of course, that they were entering a "new world." This process was repeated many times and the immigrants moved farther and farther south.

When could such migrations have taken place? They must have occurred at a time when climatic and glacial conditions were favorable. About eleven thousand years ago, at the close of the glacial period, the climate became mild enough to have permitted such migration. Earlier than that, glacial conditions would have been unfavorable. Archaeological excavations give no evidence of any human material of an antiquity greater than about ten thousand years. So, on the basis of all present evidence, the time of the first migration seems to have been between ten and eleven thousand years ago.

A peopling of the New World by any route other than the Bering Strait is highly unlikely for a number of reasons. South America is 2,000 miles from the nearest Pacific island. Chance voyages might have occurred over this route but it is most unlikely that a large group or repeated groups could reach the New World in this way. More important still is the evidence that the Pacific islands themselves were only recently settled, perhaps a few thousand years ago. So, despite all speculations about this route, it must be eliminated for these and other reasons.

Evidence of Earliest Culture.—The people who migrated into the New World were nomadic hunters, fishers, and food gatherers whose way

of life was very simple. They brought with them from Asia a knowledge of the preparation and use of chipped stone tools, of projectiles propelled by spear throwers and perhaps shot from bows, the use of fire, and possibly the domesticated dog. The oldest archaeological evidence of an early culture in North America is named Folsom from the place of its first discovery in northeastern New Mexico. Similar material was found in other parts of the Western Plains; near Clovis, New Mexico; near Fort Collins in Colorado; and near Lipscomb, Texas. The projectile points found at these sites are of two kinds, the one rough and irregular and the other very finely chipped. Some of these projectile points were imbedded in bones of extinct bison, indicating that these are quite old even though so skillfully made. But, as has already been mentioned, association of man-made material with bones of extinct animals does not necessarily mean any great antiquity in the New World. The geological evidence for the age of the Folsom culture places it at the end of, or just after, the last glacial period. The Carbon 14 date for this terminal glacial stage is about 8500 B.C. which corresponds closely to the Carbon 14 date of 8000 B.C. for the Folsom material itself. A second kind of early culture, called Cochise from a site in southern Arizona, dates somewhat later in time than the Folsom material and differs greatly from it. The Folsom people were hunters, and left only scrapers, knives, and their unique projectile points. The Cochise people, on the other hand, left few scrapers and knives and no projectile points. They did leave many grinding tools (mortars, handstones, pestles, flat grinding-stones) indicating a seed-gathering economy. From these early cultures there is an unbroken sequence of sites extending to about twenty-five hundred years ago, almost to the beginning of pottery-making and agriculture.

We have seen that man first reached the New World about eleven thousand years ago. By about ten thousand years ago there was a hunting economy in the Western Plains, and, somewhat later, a gathering economy in the southern Arizona area. The seed-gathering Cochise culture persisted, with minor changes and additions right up to the time a few hundred years before Christ, when pottery-making, agriculture, and permanent houses were added, bringing in an era of great culture enrichment. The parallel period for the hunting people is less well-known but it seems possible that such a site as Ventana Cave in southern Arizona represents this period. The earliest layers in this cave contain material of a Folsomlike culture. On top of this there is material similar to the later stages of the Cochise culture. On top of this is a pottery-bearing layer dating from A.D. 1 to A.D. 1400 and on top of this is historic Indian material.

So far, we have been describing material only from the Southwestern United States. This area is well-known because its dry climate has preserved the early material and its lack of heavy vegetation facilitates archaeological discovery. There have been a few other scattered finds. Gypsum Cave in southern Nevada yielded artifacts indirectly associated with bones of extinct animals. The material is undoubtedly early but any exact dating is impossible. The same is true of cave material from southern Oregon, Big Bend sites in Texas, and caves near Salt Lake City. The Boylston fish-weir site in Boston,

which may be four to five thousand years old, gives evidence of man in what is now the Eastern United States. Folsomlike points are found at the bottom of middens in the Eastern United States, left by hunting and gathering peoples. These middens date from 1000 to 3000 B.C.

At Tepexpan in the Valley of Mexico a human skeleton, elephant bones, and flake tools were found in one stratum. The evidence is not conclusive proof of early habitation of this site but it is promising.

Evidence from several parts of South America indicates that early migrants reached many parts of that continent, even distant Tierra del Fuego. The earliest archaeological evidence comes from three areas: the east Brazil highlands, the Andean highlands and southern Patagonia. In the caves of Lagoa Santa in the east Brazil highlands were found bones of extinct animals and human remains of a physical type different from the modern Indians. Here again, association with extinct animals does not necessarily indicate extreme age. The human skulls are, however, lower and longer than modern types. These same characteristics were found in skull material from another cave in the same region, and at Punin in highland Ecuador.

Other early campsites have been found in several parts of the Andes. In southern Patagonia cave sites at Palli Aike and Fell's yielded stratified remains from the time of the early hunters until the historic period. Material from shell middens in southern Tierra del Fuego and on the north coast of Chile indicate an early occupation by fishing groups. An estimation of the age of the Patagonian material, based on the rise of land level in relation to the sea, gives an age of eighteen hundred years for the earliest shell midden occupation. The Carbon 14 date for Indian hearths in Fell's Cave is eighty-five hundred years ago. From this we can conclude that the first migrants must have reached the South American continent considerably earlier.

The sites we have just described give us the picture of the earliest known New World cultural material. Dated by geological methods, they cover the period from roughly fifteen thousand years ago to five or six thousand years ago. In a few instances the record suggests connections with more recent material but on the whole there is still a gap in our information after about 5000 B.C. The next date which seems reasonable to assign to archaeological material falls somewhere around 1000 B.C. This is arrived at not by geological dating but from archaeological records. This record for many parts of North and South America runs back more or less consecutively from the present. The details of these sequences will be considered later. Suffice it to say here that on the basis of this material archaeologists estimate that the earliest development of the cultures in these sequences must have begun about two or three thousand years ago. This leaves us with a gap between the end of the earliest material, about 5000 B.C., and the onset of this new period about 1000 B.C. This interval will some day be filled in. We may find that our dating is at fault. Perhaps the dates of the older material are too early and the recent material too late, creating a false gap. Perhaps we will find more exact evidence for dating the extinction of the animal species found associated with the earliest human remains. Or, perhaps, additional archaeological discoveries will extend

the recent record back in time, closing the gap from this end.

During this interval there must have been expansion of population, movements of people, and diffusion of culture traits within the New World. There may also have been some movement of people and of cultural material from Asia. We know this from the distribution of culture traits existing after the end of this gap. We find that certain simple elements of culture were almost universally distributed throughout the New World. These include: pressure flaking, grinding of stone, bone and horn, hafting of tools, firemaking, weaving or plaiting of baskets, mats, traps and weirs, projectile points used with either a spear thrower or a bow, the domesticated dog. Some of these traits are known from Folsom finds but others do not leave preservable remains to tell us how old they are. Because they are all traits characteristic of late Paleolithic and Mesolithic times in Europe and Asia, they may have been brought by migration or learned through contact across the Bering Strait. They may have reached the New World at one time or over a long period of time. Whatever their age or provenience they seem to be the common basis of the native New World cultures.

This set of material traits is nearly paralleled in distribution and presumptive age by another set consisting of social and religious institutions. Such traits leave, of course, no material remains but their wide distribution among historic Indian groups in both hemispheres suggests a long history. Such traits are: small hordes of kinsmen claiming the use of a tract of land; belief in magic and supernatural powers which are used sometimes for evil; crisis rites including ceremonies performed on such occasions as birth, puberty, death. These traits, like the set of material traits, may have reached the New World at one time or over a long period. Some may have been present by Folsom times or they may have reached the New World during the gap which followed the Folsom period and about which we know so little.

Areas of Indian Culture before the Conquest.—By the time the first Europeans reached the New World, the native people had spread across both continents. The hundreds of groups in which they lived fall into several areas of fairly uniform culture, and can be described and understood best in terms of these area settings. There are some differences of opinion among anthropologists as to the exact number of areas and the particular groupings in which the various tribes fall. But, on the whole, the disagreement concerns the smallest subdivisions within the subareas. It is generally accepted that the New World can be described in terms of ten large areas which can be divided at least once, giving twenty, or more, subareas.

The cultural areas into which the Indian tribes can be divided correspond closely to natural areas considered in ecological terms. This relation between cultural and natural areas does not imply that cultures are produced entirely by their environment. However, once established in an environment a culture tends to be stabilized and limited by that environment. Of the various aspects of environment (climate, terrain, altitude, fauna, vegetation) which affect culture, vegetation is perhaps the most important. There is a close correspondence between the cultural and vegetation areas in North and South America.

In North America there are six basic culture areas: Meso-American, Southwest, Intermediate (California and Intermountain), Northwest Coast, Eastern-Northern, and Arctic Coast. In South America there are four: Andean, Circum-Caribbean, Tropical Forest, and Marginal. Each of these areas is divisible into two or more subareas. The division of the New World into two continental areas creates a false impression of independent growth. Actually, the Meso-American and Andean areas together form a bicontinental core of development. By the 15th century when the Caucasians reached the New World, these two areas constituted a peak of development far ahead of any other areas in density of population, advancement of arts, political development and wealth. Archaeological evidence from these areas indicates that at the earliest known stages (some centuries before Christ), they were already far advanced. They were, in fact, already developed to a point which was never reached in many other areas.

This same circum-Isthmian region is the place of origin of native American cultivated plants. The most important of these, beans and maize could also be grown in more temperate latitudes. With the diffusion of these plants to areas outside their point of origin, it seems likely that other traits of culture would have spread. Some of the results of this occurrence will be seen in the following description of the culture areas. These will be given from the Andean and Meso-American areas outward for each of the two continents.

SOUTH AMERICAN CULTURE AREAS

Setting.—The South American continent is divisible into three major topographic zones:

(1) the Andean region stretching along the Pacific Coast from Colombia to southern Chile; (2) the Tropical Forest area from the eastern slopes of the Andes across the valleys of the Amazon and the rivers of the Guianas, and including the eastern hill and coast area of Brazil; (3) the Tropical and Temperate Plains area stretching from Brazil to Tierra del Fuego. A fourth area, of interest as a cultural entity, is somewhat peripheral to continental South America. This is the Circum-Caribbean area which includes northern South America, all the West Indies, and Central America as far as the present Guatemalan border. The relation of this area to both the North and South American continents is complex and will be described in a later paragraph.

Race.—The South American Indians belong to the American Indian race which is a subdivision of the Mongoloid stock. The characteristics common to all South American Indians are straight, black hair, brown skin and brown eyes. On the basis of other physical characteristics they may be divided into four subtypes. The Indians of the Andean area are short of stature and brachycephalic (round-headed); the Indians living in the Tropical Forest area are short to medium in stature and mesocephalic (medium-headed); the Indians of the Matto Grosso, the Pampas, and Patagonia are tall and round-headed; the Indians of the highlands of Brazil, southern Chile and the Straits of Magellan are of medium to low stature and dolicocephalic (long-headed). The real significance of these differences in stature is not entirely clear. They may represent a difference in physical type, or they

may be the result of differences in the kinds of food eaten by the various groups. With regard to head shape, evidence of dolicocephalic traits was found in the earliest archaeological sites in Ecuador and southern Brazil. This early evidence plus the presence of this long-headed type in the furthest part of the continent suggest that this may have been the characteristic type of the earliest inhabitants of South America. The round-headed type may have developed from the earlier type or, more probably, represents a later, separate migration.

Language.—The Indians of South America spoke about 250 languages, which are classified into some 40 linguistic stocks. At the time of discovery, the number of people speaking any of these different languages varied greatly; some were spoken by only a few hundred people living in a small area, others were spoken by many tribes spread over huge areas. In the Andean area, the principal linguistic families, from south to north, were the Araucanian, Aymara, Quechua, and the Chibcha which extended into Central America. Most of the Indians of the tropical forest spoke languages of the Arawak, Carib, Tupi, Pano, and Tucano families. Arawak and Carib extended into the West Indies. The Indians of the open country from Brazil to Tierra del Fuego spoke, for the most part, languages of the Gé, Guaycuru, Puelche, and Tehuelche families. Some of this linguistic distribution occurred rather late, perhaps a few hundred years before the conquest. The expansion of the Inca Empire, for example, was responsible for the wide distribution of Quechua and the suppression of local languages. The Incas, however, never succeeded in suppressing the Araucanian-speaking people of northern Chile who, today, speak that language. Other languages such as Arawak, Carib, and Tupi were spread by extensive migrations.

Prehistory.—The earliest migrants into South America were nomadic people who lived by hunting, fishing and gathering wild foods. They were not very different from their ancestors who had crossed the Bering Strait from Asia into the New World. Like those ancestors, the early migrants into South America had no knowledge of agriculture, metals, or pottery. Aside from such areas as the jungles of the Ecuadorian and Colombian coasts and of the Amazon, the extreme desert of northern Chile and the areas of the Argentine suitable only for the later herders and farmers, the South American continent provided extensive areas favorable for these early nomads. The highlands of the Andean mountains supplied the game and wild food suited to their needs. Because the main valleys of the Andes run north and south, a continuous southward migration was possible and doubtless accounted for the main flow of settlers. Some early groups also found suitable fishing sites along the Pacific coast. Others spread eastward from the Andean area into the east Brazil highlands, which also offered good hunting. Further country suitable for hunting and gathering wild foods was found in the Pampas and Patagonia, and on into Tierra del Fuego. Some of these hunting and gathering people were still living in the east Brazil highlands, the Pampas, Patagonia, and the Chilean archipelago at the time of the European conquest.

The earliest archaeological material from South America consists of two kinds: human skeletal material found associated with extinct

fauna, and cultural remains found at campsites and fishing sites.

In 1835 about 800 caves in the Lagoa Santa area of the east Brazil highlands were explored by T. W. Lund, a Danish naturalist. The material from these caves consisted of bones of extinct fauna and some human skeletal material. The human material was especially interesting because it represented a physical type somewhat different from the modern Indians of that area. Material excavated from the Confinis Cave in the same area corroborates the earlier discoveries. At Confinis a human skeleton and parts of a fossil horse and of mastodon were found buried about two meters deep and sealed in by fallen debris. As has been mentioned in a previous paragraph, the exact age of extinction of New World fauna is uncertain but it does not necessarily imply great antiquity. In 1923 another fossilized human skull was found indirectly associated with extinct fauna in volcanic ash beds at Punin in the highland of Ecuador. The human skull material from these three areas, Lagoa Santa, Confinis, and Punin are of a similar long, low type. Early campsites have been found in several places in the Andes. These contain stone tools such as points and scrapers. Two early cavesites, in southern Patagonia, Palli Aike and Fell's, (with a Carbon 14 age of eighty-five hundred years), contained stratified deposits of material ranging in age from the time of the early hunters up to the occupation by the historic Ona. Fishing sites have been excavated on the shores of southern Tierra del Fuego, the Chilean archipelago and the coasts of Chile and Peru. The oldest known shell midden age is about eighteen hundred years.

The story of the succeeding migrations and culture changes is still only incompletely known. Migrants probably continued to reach South America because the later physical type is short and round-headed. The one area from which we do have a fairly continuous history is the north coast of Peru. Evidence from buried villages indicates that the fishing people who lived here were raising cotton, beans, and gourds as early as 2000 B.C., although they did not make pottery or raise corn or manioc at that time. In this same area evidence is found of such subsequent developments as the making of pottery, domestication of the llama, cultivation of corn, manioc and other plants, the introduction of weaving, the use of metals, irrigation and the whole elaborate growth of art, architecture and a complex political organization.

Domestication of plants and of wild animals was of great importance in the development of New World cultures. With the possible exception of gourd and cotton, the domesticated plants of the New World are indigenous species, unrelated to plants of the Old World. Recent botanical investigations point to the conclusion that plants such as maize, sweet potatoes, peppers, peanuts, manioc and tobacco, which are each represented by a single species, are of South American origin. The lowland country, possibly the grassland of Paraguay and Bolivia seems a likely center of origin. Because maize became such an important crop in many parts of the New World, its domestication is of particular interest. It seems probable that maize is South American in origin because that is where the greatest number and most differentiated varieties of maize are found. Specifically, it seems probable that maize

was developed from pod corn and that this development took place around Paraguay.

Other plants such as squash, beans, tomatoes, and cotton, which are represented by two or more species, may have been domesticated independently in South America and in Central America. Still other plants such as coca, the white potato, quinoa, and oca seem to be Andean in origin. Some of these plants achieved a wide distribution in the New World. But such an achievement would not have required any great span of time. Botanists consider that the whole process of domestication could have been completed in a few thousand years. We know that the Indians of the Peruvian coast, for example, had domesticated plants before they made pottery, probably about 2000 B.C. This would allow ample time beforehand for the process of domestication and time afterwards for the wide distribution of these plants.

The dog was the only domesticated animal known widely over South America. A few animals, such as the guinea pig and the llama and alpaca were domesticated in the Andean area. The guinea pig was known in many parts of the Andes but was not a very important animal. The llama and alpaca, probably domesticated at an early date from their wild relatives the guanaco and vicuña, were restricted to the high grasslands of the Central Andes and parts of northwestern Argentina. They were useful for transportation and as a source of wool, meat, hides, fertilizer, fuel and of bone for tools.

Cultures.—South American Indians can be grouped into four areas of native culture: (1) Andean, (2) Circum-Caribbean, (3) Tropical Forest, (4) Marginal.

Andean.—In terms of cultural development the Andean area consisted of three subareas, the central area of high culture flanked by the North and South Andean areas. The basic pattern common to the whole area at the time of the Spanish Conquest, was one of skillful farming which included the use of fertilizers and the building of irrigation ditches and elaborate agricultural terraces. Corn, beans, squash, potatoes, manioc, peanuts and peppers were the principal food crops. Cotton, coca and tobacco were also grown. The llama and alpaca served, in the central highlands, as pack animals and also as an important additional source of meat, and of wool and bone. Guinea pigs were widely raised for food.

The Andean farmers were also skillful craftsmen. They distinguished between two types of products, one for utilitarian purposes, and one, which was more elaborately and carefully made, for ceremonial or mortuary purposes. The pottery, weaving, and metal work showed many different styles at different times and places but was of a uniformly very high level of skill and beauty. The more skilled craft work was done by specialists, while the utilitarian wares were produced by each family. In contrast to most of the rest of South America the Andean people were sedentary and lived in centers of fairly dense population. Houses in the Central Andes were constructed of stone and adobe. In Colombia and Ecuador frame houses with thatched roofs were lined with stone or clay. The Auracians in Chile built plank houses. In all these localities each household consisted of closely related families and a village was made up of several such households. Each village had its own chief and

was usually also a religious unit. During long periods of their history these villages were united into larger political units. This development reached its height under the Inca who created a political empire extending from Ecuador to Chile.

The pattern of this Andean farmer culture was fairly uniform in the Central Andes over a long period of time. From extensive archaeological work in this area it is possible to reconstruct the development from very early beginnings to its greatest height under the Inca Empire shortly before the Spanish Conquest. In the Chicama and Viru valleys on the north coast of Peru there is evidence of an agricultural people who did not yet make pottery. This material dates from about 2000 B.C. and may well be the earliest New World culture which practised farming but lacked pottery. The subsequent cultural development had, of course, many local variations but was also marked by a surprising degree of uniformity. Three successive waves of cultural influence spread over most of the area. These are named Chavin, Tiahuanaco, and Inca, and may be dated respectively at about A.D. 1, 1000, and 1450. Each of these cultures is represented by stylistic differences in pottery, textiles, metalwork, and building construction.

The Incas, who were the last in this sequence, were originally a small tribe inhabiting Cuzco, a mountain valley in southern Peru. By means of a series of military victories, they conquered the tribes around them until they controlled an empire of six million subjects living in a territory which extended three thousand miles from Colombia to Central Chile. The Incas constituted the ruling class in their empire and established their capital at Cuzco. The characteristic enabling the Incas to build up and then maintain this huge empire was their ability to organize and administer. The state consisted of administrative units beginning with the empire itself and going down through the provinces and districts to the villages. The emperor was at the head of the officers administering these units and his power was absolute. He was, in fact, thought to rule by divine right because he was descended from the Sun, the chief Inca deity. All military and governmental officials were chosen from among the descendants of past emperors, concentrating the power in a small group.

When the Incas conquered a new tribe, much of the local culture was left undisturbed, but the group was incorporated into the empire and required to assume the cult of the sun. Quechua, the language of the Incas, was also the official language of the empire and replaced the local languages. The local leaders were absorbed into the administrative structure of the government. The farmland was divided into three parts for the support of the state, the Inca priesthood and the people. Everyone was required to work on these lands and also on public works such as roads. To insure loyalty and to spread their culture and the Quechua language, the Incas frequently transplanted thousands of people from one district to another. This was sometimes done to equalize population distribution and sometimes to minimize dissatisfaction. All aspects of their subjects' lives were rigidly controlled by the ruling Incas. There was a minimum of individual, personal liberty. However, all government officials were held responsible for the well-being of the people under them.

The communication necessary to maintain such an intricate administrative machinery was made possible by an elaborate system of roads. There were two roads stretching the length of the empire. One lay along the coast. The other, highland, road was paved with stones, ascended steep gradients by means of steps, and crossed rivers and gorges by means of suspension bridges up to 300 feet long. These two main arteries were connected by lateral roads which tied the whole kingdom together. Posthouses, storehouses, and inns were built at frequent intervals along these roads. The posthouses were only two or three miles apart so that a system of couriers could carry messages from one to the next. The storehouses and inns were, perhaps, fifteen miles apart and were for the convenience of official travelers as well as for the storage of food and arms. Another development which facilitated the administration of the empire was the Inca *quipu*. This was a counting device operated on a principle similar to that of the abacus. The *quipu* consisted of a thick cord from which hung knotted strings of different colors. The number and position of the knots represented numbers in a decimal system. The colors of the strings represented different kinds of objects. This device was used to keep statistical records of military, economic, and population matters. The Inca never developed any system of writing but the *quipu* enabled them to keep records of a limited variety.

Inca culture was really the culmination of developments which had been going on for a thousand years. Some of these reached new heights under the Incas who excelled in engineering and architectural skills. Besides the roads, which have already been mentioned, the Incas built elaborate systems of irrigation ditches and agricultural terraces. The ditches were sometimes cut through solid rock or carried along sheer cliffs on stone aqueducts. The stonefaced agricultural terraces covered entire slopes from the valley floor to the summit. The Incas also accomplished remarkable architectural feats. Their houses were simple stone or adobe structures with roofs of grass thatch. Their public buildings, on the other hand, were massive structures built with great skill. The construction was of huge dressed stones, laid without mortar and fitted with greatest exactness. These stones were sometimes cut into polygonal shapes and the edges were beveled. Among these buildings were palaces, temples and fortresses. The enormously imposing structures in the Cuzco area such as the fortress of Sacsahuaman, the temple at Ollantaytambo and some of the buildings at Machu Pichu date from the late Inca times and were the final examples of this development. The Incas were competent potters and weavers and did skillful work in metals, but they did not achieve such impressive results in these crafts as they did in the engineering and architecture. Their weaving and pottery were, in fact, less imaginative than were those of earlier periods.

When Francisco Pizarro, leading the Spanish invaders, arrived in 1532 he was able to conquer the Inca Empire with surprising ease. This conquest was facilitated by a struggle which was taking place within the Inca dynasty. Pizarro capitalized on this state of civil war and, after the two Inca claimants to the throne were killed, he was able to take over control of the whole empire.

The Northern Andean subarea included Ecuador and highland Colombia. The people here were also sedentary farmers but their culture was in no way as highly developed as that of the Central Andes. Their greatest skill was in metal-working which was like that of the people of the Isthmus of Panama. The Chibcha at the northern extremity of this area had an elaborate political development with autocratic hereditary rulers.

The South Andean area included southernmost Peru, the north Chilean desert, a corner of northwest Argentina and a high, fertile stretch of Chile. The Calchaqui or Diaguita of northwest Argentina show some influence from the Tiahuanaco and Inca periods of the Central Andes. The Chiriguano came up from the area where Peru, the Chaco, and the Tropical Forest areas meet to challenge the Inca on their eastern border and were in turn influenced by Inca culture. The Araucanian farmers of central Chile seem to have been fairly independent of Inca influence and to have resisted, also, the Spaniards.

Circum-Caribbean.—The part of this area lying along northern South America, the Isthmus of Panama and up to the Guatemalan border was occupied by Chibcha-speaking peoples. The cultural development of these peoples was much less elaborate than in the areas to the north and south of them. The Chibcha were agriculturalists; they constructed irrigation systems and raised maize, potatoes, manioc, beans, and squashes. They also raised cotton and did fine weaving. Their houses were built of wattle and plaster, and they also built roads and suspension bridges. Their greatest handwork was of gold, in which they excelled, and which they traded as far away as the Maya, perhaps even beyond there to Mexico. The Chibcha lived in palisaded villages organized into a compact political system. Taxes or tribute were exacted in gold or cloth, and they also had markets and a kind of currency. Chibcha religion involved many sacrifices including human sacrifices to the sun. The religious leaders formed an organized priesthood with a leader. The fringes of this Isthmian culture extended into the highlands of Venezuela and, on the south, as far as the Inca area in Ecuador.

The island part of this Circum-Caribbean area was occupied by Arawak and Carib-speaking peoples. The orientation of their culture was toward the South American mainland. The earliest, pre-agricultural culture survived longest in western Cuba and the Bahamas. A Taino-speaking people, related to the Arawak in South America, overran this early population in most of the remaining islands. The place of highest development was in Puerto Rico and Haiti. Following the Taino came the Carib-speaking people, also from the South American mainland. And, lastly, the Spaniards arrived, and the native cultures disappeared so rapidly that our knowledge of them is very meagre.

Tropical Forest.—This area included the huge expanse of the Amazon Valley, the upper Orinoco, the valleys of the Guianas rivers and also the hill ranges and coast area of eastern Brazil. The river areas were true rain forest where travel was primarily by canoe, metal was completely absent and stone was very scarce. The hill and coast area was scrub forest. Food was actually fairly scant in this whole area so the people lived thinly scattered. Fish were

an important source of food and they were caught in nets and traps, shot with arrows, or stupefied with poison. Hunting was done with bows and arrows and blowguns with poison darts. Practically all tribes farmed. The most important crop was cassava, although maize, squashes, beans, pineapples, and cotton were also raised. Manioc meal and tapioca were obtained from the cassava by means of graters, squeezers, and roasters, the poisonous juice being expelled by means of a most ingenious basketry press. One use of the cotton was in making hammocks, which seem to have been invented in this area. There was some pottery-making and weaving of cloth. Enormous dwellings housing a whole village of related families were made of thatch and supported on posts.

Although the dense vegetation and the tropical nature of this jungle area prevented the penetration of the aggressive Inca into it, the tropical forest tribes themselves moved about on the rivers quite easily and frequently. Most of their migrations were in search of new lands to farm. The wide scatter of different linguistic groups in this area reflects the frequency of migrations. Several villages speaking one dialect constituted a tribe but they had no formal organization. The villages were situated close to the rivers. Each had a chief and a council of male adults. Religious life was simple and medicine men carried out curing rites.

The thickness of the jungle vegetation has impeded archaeological investigation of the early history of much of this area. The Lagoa Santa and Confins caves in the east Brazil highlands have already been mentioned in connection with the discussion of early migrants. It is possible that the coastal shell middens will yield some information. On Marajo Island in the mouth of the Amazon River excellent, pre-Columbian pottery has been found. This pottery is modeled, incised and painted and certainly represents the finest workmanship of any kind east of the Andes.

Marginal Area.—The long area extending from the east Brazil highlands across the Chaco to the southern tip of South America was made up of two subareas. The southern part was occupied right up to the conquest by nomadic hunting tribes whose life was doubtless similar to that of the earliest nomadic hunters. In this area lived the Alacaluf and Yahgan Indians of the Chilean archipelago, and the Ona and Tehuelche of Patagonia. These four tribes are the most primitive in the New World and compare, in this respect, with the Australian natives and the Bushmen of South Africa. The Alacaluf and Yahgan Indians subsisted on the marine life of the archipelago, hunting seals and other sea mammals, gathering shellfish and fishing. The Ona and Tehuelche hunted land animals and gathered wild plants. Both groups had simple, portable skin shelters which they erected on stick frames. Their clothing consisted of capes, mocassins, and sometimes leggings which the Ona and Tehuelche made from guanaco skin while the Alacaluf and Yahgan used sealskins. All four tribes greased their bodies for protection against the cold, which was very severe. Both the mainland and the archipelago Indians had the simplest tools and utensils of bone, shell, stone and bark. The canoes of the Alacaluf and Yahgan were made of strips of beech bark sewn together and held in place by split saplings.

The middle part of this marginal area was the Chaco, an open plain where the Puelche, Que-randi, and Charrua tribes lived. These tribes were fairly large and warlike. Their culture was not quite so simple as that of their more isolated neighbors to the south. They made some use of wood for utensils, ground seeds in stone mortars and, along the borders of this area, had acquired some pottery from their northern neighbors. Upon the arrival of Europeans and more particularly with the introduction of the horse into this area, these Indians readapted their culture and developed a life similar in many superficial respects to that of the Plains Indians of North America.

The Gê-speaking tribes are the northernmost group in the Marginal area and occupy the savanna and scrub country of east Brazil. Hunting, gathering, and fishing are important with the addition of some farming of sweet potatoes and yams. Their technology is also fairly simple although a few tribes make pottery. These tribes have, however, a rather complex social and ritual organization. Some of these Indians live in villages with a population of nearly three hundred. There is little or no intervillage organization. Each village is usually divided in halves for the regulation of marriage, performance of ceremonials and for competitive games. There are also ritual societies for the performance of ceremonials.

Very little is known of the prehistory of this whole Marginal area. Nothing has been found which would indicate any previous higher development. It is assumed that the simple culture in this area is a survival of the early cultural poverty.

NORTH AMERICAN CULTURE AREAS

Setting.—The North American continent includes a great range of topographic zones: Arctic, Mountain, Plains, Prairie, Woodland, Desert Plateau, and Jungle. In terms of native cultures, these topographic zones combine into six culture areas each of which may have several subareas: (1) the Meso-American area covering the region from central Honduras and El Salvador to northern Mexico; (2) the Southwestern area covering the desert and plateau regions of New Mexico and Arizona; (3) the Intermediate area including California and the intermountain region; (4) the Northwest coast area from Oregon north to Alaska; (5) the Arctic area; (6) the huge remaining area of Canada and the United States east of the Rocky Mountains constituting the Eastern-Northern area.

Race.—The Indians of North America, with the exception of the Eskimo, belong to the American Indian race which is a subdivision of the Mongoloid stock. The Eskimo are classified as Arctic Mongoloid because they show less admixture of non-Mongoloid stocks. Setting aside the Eskimo, the remaining North American Indians show some variation in head form and stature. The tribes of the Plains area are generally taller and more long-headed than, for example, the Indians of the Southwest and Meso-America. Here, as in South America, the differences in stature may be due to diet as well as to physical type.

Language.—There were 40 or more linguistic families in North America, some of which were spread over huge areas, others spoken by a few hundred people. The principal families, in

terms of numbers and cultural importance, and the well-known tribes representing these families were: (1) Eskimo, spoken along the Arctic coast from Alaska to Greenland; (2) Athabaskan, spoken by the Beaver, Dogrib, Yellow Knives, Carrier and others in the northwest interior of Canada and Alaska, by the Hupa, Kato and others in California and Oregon, and by the Navajo and Apache in Arizona and New Mexico; (3) Algonquian, spoken by the Arapaho, Cheyenne, and Blackfoot of the Plains area, by the Sauk and Fox, Cree, Menomini, Shawnee, Ojibway, Delaware, Kickapoo, Miami and others in the great expanse of eastern Canada, the area around and south of the Great Lakes, the New England and Middle Atlantic states area; (4) Iroquois, spoken by the Cherokee, Huron, Erie, Mohawk, and Seneca and others in the area of New York, Pennsylvania, Ohio, and adjacent territory; (5) Siouan, spoken by such Plains tribes as the Dakota, Assiniboin, Omaha, Osage, Hidatsa and Crow; (6) Muskogean, spoken in the southeastern area by Choctaw, Chickasaw, Creek, Seminole, Natchez, and others; (7) Uto-Aztecan spoken by the Aztec, Seri, Yaqui, and others in Mexico, by the Hopi and Pima in the Southwest, and by the Ute, Comanche, Shoshone and others from Wyoming to southern California and across to Texas; (8) Maya, spoken in Guatemala and Yucatan, plus a small area further north in the Mexican State of Vera Cruz.

Prehistory.—The oldest evidence of North American prehistory was quite thoroughly described in earlier paragraphs. Here we will summarize such material as is necessary for our subsequent description of the native cultures which developed from this early base. The first migrants probably reached the North American continent about eleven thousand years ago fanning out slowly over the two New World continents wherever they found wild game, wild plants, and fish. The earliest known cultural materials in North America are from the Sandia Cave in New Mexico; the somewhat later Folsom people who were present in the Southwest by 8000 B.C., and of the Cochise people somewhat later still. Evidence of the persistence of the Cochise culture and the gradual addition to it of farming and pottery-making fill in the local, southern Arizona story up to the Christian era. At this point these early developments tie in with the known sequences of cultures which have been carried back from the historic period to the early years of the Christian era in Meso-America, the Southwest, and east of the Mississippi.

Cultures.—North America can be divided into six areas of native culture: (1) Meso-American, (2) Southwest, (3) Intermediate, (4) Northwest coast, (5) Arctic, and (6) Eastern-Northern.

Meso-American.—This area includes Mexico, except for its most northern part, British Honduras, Guatemala, and the adjacent parts of Honduras and El Salvador. For many years it was believed that the several cultures which reached a high degree of development in this area did so independently of each other and with only their most primitive phases in common. Recent archaeological work indicates that there was contact over practically all of this area during most of its history. Several culture patterns which were interrelated in origin became distinct, local developments from a common basis. These local developments will be considered from south to north.

The Maya people fall into two groups: the Lowland Maya lived in Yucatan, British Honduras, and the Peten district of Guatemala. They spoke Maya and such closely related dialects as Chol, Chorti, and Chontal. The Highland Maya occupied upland Guatemala and spoke the Quiche, Cakchiquel, and Mani dialects of Maya.

An erroneous early theory maintained that the Maya had domesticated maize and were the first American farmers. More recent botanical evidence indicates that maize is probably South American in origin. This information is of interest because it was assumed for many years that the elaborate Maya artistic and intellectual development went hand in hand with their skill as agriculturalists. Actually, plant domestication probably took place two thousand years before the great rise of Maya culture and several thousand miles further south.

The earliest period known for the Lowland Maya is called Formative and is based on pottery-types and other refuse-heap material from sites in the Peten district of Guatemala. During this period the basic Mayan astronomy, writing and mathematics were being developed. These intellectual achievements, the Maya calendar which is based on them, and the magnificent artistic expression reached their height during the classic period. The beginning of this period is set by the earliest known date of the Maya calendar—317 A.D. The calendar, based on centuries of astronomical observations and mathematical calculations, was exceedingly accurate. Calendrical inscriptions were used primarily to record ceremonial dates and are found inscribed on stone monuments in all parts of the Lowland Maya area. The Maya were also very skillful potters, lapidaries, sculptors, painters and architects, as is attested by the contents of tombs and by the buildings found in the Peten district and in Yucatan. They also built ball courts for the playing of a ritualistic game with a rubber ball. These skills were doubtless practiced by specialists. The average Mayan was a farmer living in a wood and thatch house near his field. Maize, beans, squash, pumpkins, sweet potatoes, avocados, and cacao were the food crops, while cotton and hemp were also raised. The farming technique required burning and slashing the jungle growth. New fields had to be cleared often because the jungle grass grew so luxuriantly in a field cleared of brush. The domesticated animals included turkeys, dogs, and bees. Wild pig and deer were hunted with blowgun, bow and arrow, poisoned darts or traps. The Maya lived in independent city-states each of which was a unit and had its own religious center. Each city-state was ruled by its priests.

The Maya classical period came to an end in the early 10th century. The late period, which followed, was characterized by a decline in Maya culture and the abandonment of their great cities in the Peten. They continued to occupy some of their cities in Yucatan where there was some local persistence of Maya culture but also a strong influence from the Toltec people of the Valley of Mexico on art styles and religious cults. Warfare among the city-states also developed. It was at the end of this period that the Spaniards arrived, conquering the Maya in 1540.

The Highland Maya never achieved the rich development of the Lowland group. They did have the calendar but their artistic development was not spectacular.

During the years in which Maya culture was growing and declining other developments were taking place to the northwest in the Valley of Mexico. These developments used to be described in the sequence Archaic, Toltec, and Aztec. Since the earlier 1930's this overly-simple sequence has been changed. The Archaic was clearly a well-developed pattern and so was renamed middle, leaving the term "early" for an, as yet, unidentified period. The subsequent periods are called Teotihuacan, Toltec, Chichimec, and Aztec.

The middle period is represented as gradually developing around the old Lake Texcoco which then was at a higher level. Farming, pottery-making and weaving were already practiced and the people lived in villages. They made large numbers of baked clay figurines, which evidently were of religious significance. Some middle period sites lie under a lava flow, leading a few people to assign a great antiquity to them. Geologists, however, do not agree. It seems much more likely that these sites fall somewhere between 350 B.C. and the year zero.

The Teotihuacan period overlapped at its early end with the middle. The fully developed Teotihuacan period was most impressive. The huge Pyramid of the Sun (700 feet at the base and over 200 feet high) dominates an enormous ceremonial center whose buildings are decorated with sculptures and murals. Teotihuacan culture seems to have reached its highest development about A.D. 500. The influence of the Teotihuacan style, probably spread by means of trade, has been traced to the coast, to the Monte Alban site in Oaxaca, to a site near Guatemala City, and to a classic Maya site in the Peten. It was once thought that the Toltec people had built Teotihuacan but, actually, they established their capital near Tula several centuries later. We have already noted their influence on the Maya of Yucatan. Some of the history from Toltec times on is known from records kept in picture writing. These records list kings' names and describe the defeats and victories of some of the cities from the ninth century to the Spanish Conquest. The Toltecs were displaced by the warlike Chichimecs from the north, and for some centuries there was warfare among the cities of the valley.

In the 13th century another invading tribe, the Aztecs, descended on the valley from the north. By 1324 they had established their capital at Tenochtitlan and, by gradually strengthening their position through alliances and conquests, finally dominated an empire extending to the Isthmus of Tehuantepec. Warfare was an important aspect of Aztec life and played a part in their religion, their social organization and their economy. All Aztec conquests were for the sake of obtaining tribute for their treasury and prisoners for sacrifices in their religious ceremonies. The Aztecs were primarily farmers raising maize, beans, squashes, sweet potatoes, tomatoes and chili peppers. They also raised cotton and maguey for the fibers. They had domesticated dogs and turkeys, caught fish with hooks, nets and weirs, and hunted deer and wild fowl with bow and arrow, spear thrower, nets and darts. In addition to weaving, the Aztec men did excellent work in wood, stone, masonry, metal and pottery. Some of these crafts were organized into hereditary guilds. The craftsmen traded their wares at markets or sold them for cotton cloth, cocoa beans or copper axe blades



"Singing In The Clouds."



"Only Child."

BLACKFEET INDIANS



"Plume."



"Big Face Chief."

AMERICAN INDIANS



A Pueblo Indian boy of New Mexico in dance costume.

AMERICAN INDIANS



Left: Navajo Indian woman weaving a rug. Right: A Seminole girl of southern Florida. Her "hat" is her own hair wrapped around a crescent-shaped cardboard or wooden base.



A Hopi Indian social or nonreligious dance. In religious dances, costumes are often more elaborate, with masks and paint.

(Center left) Annan Photo Features; (others) Andre de Dienes

which were considered to be a kind of currency. All these wares were also carried long distances by itinerant merchants who traded them with other tribes. Their houses were of simple size and construction. They also built large earth pyramids, faced with sculptured masonry, which were bases for altars and temples. Their capital, Tenochtitlan, was on an island connected with the mainland by causeways and protected from attack by drawbridges.

Aztec society was divided into four classes and was ruled by a king and his advisers, a council of representatives from the 20 clans which included the majority of the people. The king was also the war chief. The religious life of these people was conducted by priests, and consisted of a great many ceremonies pertaining to agriculture and warfare. The ceremonies were performed according to a ritualistic calendar which consisted of two hundred and sixty days divided into thirteen "months" of four "weeks" each, the week having five days. The Aztec also had a solar calendar of three hundred sixty-five days divided into eighteen "months" of twenty days each plus five supplementary days. Each division of both calendars had its own god who was considered to influence the events of that day. Before undertaking anything important, an Aztec always consulted the calendars to determine the appropriateness of the day. Another matter of interest in Aztec life was a game with religious and mystical importance played with a rubber ball in a large stone court.

In 1519 the Spanish soldiers landed at Vera Cruz with their leader Hernando Cortes. For two years the Aztecs succeeded in resisting them. Finally, Montezuma II (1480-1520) was imprisoned, hundreds of Aztecs were massacred, and the Spaniards, aided by reinforcements, conquered the Aztecs.

Outside these areas of highest development in Meso-America lay the Huastec, Totonac, and Olmec people of the Atlantic coast and lowland, the Zapotec of Oaxaca, and the Otomi and Tarascans to north and west of the Valley of Mexico. Of these, the most is known about the Zapotec, who seem to have had a distinctive culture touched by both Maya and Valley of Mexico influences. From a late period at the site of Monte Alban comes the famous gold jewelry made by the Mixtecs who conquered the Zapotecs.

To the north, across the rest of Mexico, lived Indian groups who had some characteristics of Meso-American culture but none of its highest developments. Farming was practiced in the western half and good pottery and some stone construction were made all over but neither the calendar nor picture writing were present. The archaeology of this area is not yet well known. It is, however, potentially very important because across it flowed the cultural influences which, we will presently see, reached the southwest from the high cultures of Meso-America.

Southwestern.—This area includes part of northern Mexico, all of New Mexico and Arizona, and the southern part of Colorado and Utah. Much of this area is very dry, with a rainfall of 10-15 inches a year. There are also high plateaus, mountains and mountain valleys, which receive 22-40 inches a year. The Southwestern area has been a particularly rich one for anthropological research. The country lends itself to archaeological reconnaissance and excavation because of its openness and its arid climate

which affords excellent conditions for preservation. In addition, it is the first area for which any precise system of archaeological dating was developed. This technique, known as dendrochronology, is based on a comparison of the growth rings of trees. By a careful comparison of the rings on timbers and other wooden objects found in archaeological sites, with the rings on a master chart, dates for these sites are determined. This technique has carried dating back from the present to A.D. 11. As a result of these conditions, a fairly full story is known of the rich development of early cultures up to historic times. The main prehistoric Southwestern cultures were the Anasazi, the Hohokam, and the Mogollon. The Anasazi people (consisting of the early Basket Maker and their actual and cultural descendants, the Pueblo) lived on the plateau of northern Arizona and New Mexico. The Hohokam culture was parallel in time to the Anasazi, centered in the southern Arizona desert, and was ancestral to the present-day Pima and Papago of that area. The Mogollon culture centered in east central Arizona and west central New Mexico in mountainous country. It probably descended from the earlier Cochise culture.

The Anasazi culture sequence is made up of stages referred to as Basket Maker and Pueblo. It is not known just what preceded the Basket Makers. The earliest Basket Maker period dates from about 100-500 A.D. These people practiced agriculture but did not make pottery. As their name suggests, they wove many articles including baskets, bags, and sandals. They used the spear-thrower but did not have the bow and arrow. Their houses were temporary structures but they did line their food-storage pits with stone slabs which may have marked the historical beginning of their subsequent stone construction. A Modified Basket Maker period lasted from about 500-700. Turkeys had been domesticated and more varieties of maize introduced, and pottery-making was begun. Following this, the sequence of Pueblo development has been divided into five stages each a little richer and more complex than the one before. Pueblo I (700-900) had added the bow and arrow and cotton for cloth. Both were probably imports. Some masonry houses were built and a pottery decoration called corrugating was introduced. In the Pueblo II period (900-1050) rooms with common walls were built forming dwelling clusters so well-known for later years in this area. In Pueblo III (1050-1300) times, polychrome pottery decoration was begun. This was the period of the greatest development of masonry houses including such impressive and well-known sites as Mesa Verde and Chaco Canyon. Pottery-making and design also reached a high point in the Mimbres style. Pueblo IV (1300-1700) was a period of expansion and cultural development. By this time some of the present-day Pueblo towns were already occupied. It seems likely that the Pueblo ritual development, which was to become so elaborate, has its origin in this period. The Spaniards first reached the Southwest in 1540.

The villages of the historic Pueblo people, still lived in today, fall into three geographical groups: the Hopi (Walpi, Sichomovi, Hano [Tewa], Shipaulovi, Mishongnovi, Shungopovi, and Oraibi); Zuni (Zuni proper, Pescado, Nutria, and Oja Caliente); and the Rio Grande (Taos, Picuris, San Juan, Santa Clara, San

Ildefonso, Tesuque, Pojoaque, Nambe, Jemez, Pecos, Sandia, Isleta—all of which speak Tanoan languages; San Felipe, Cochiti, Santo Domingo, Santa Ana, Sia, Laguna, and Acoma—all speaking Keresan languages). Although there are differences among these three groups, they share such basic traits as dependence on maize and other cultivated foods; masonry construction; weaving on upright loom done by the men; cultivation of cotton; domestication of the turkey; common-wall houses; decorated pottery. These Pueblo people do some hunting including the deer and rabbit, and rabbitskin strips are woven into their clothing. They make basketry and do work in turquoise and metal which was unknown until introduced by the Spaniards. Pottery and such ceremonial paraphernalia as sand painted altars and masks are skillfully made and beautifully decorated.

Although differing still in detail, the Pueblo groups all have complex social groupings based on kinship relationships which are important in ceremonial and economic matters. Each village is also an independent unit which elects its own officers. The most elaborate flowering of Pueblo culture is in its ceremonial life. Ritualism is highly complex and includes elaborate masks, costumes, shrines, fetishes, dances and ritual acts. Many priests and religious societies are involved in carrying out the annual round of ceremonies some of the best-known of which are the Hopi snake dance, the numerous rain ceremonies and the masked dances of the kachinas.

Some of the initial stages and early development of this general pattern may be seen in the Pueblo IV period of the archaeological sequence. This same era saw the arrival of the Spaniards who first reached the Southwest in 1540 under the leadership of Coronado. The Indians were very hostile and because the Spaniards found no such treasure in this area as they had in Meso-America and Peru, it remained of interest to them primarily as a missionary field. It was not until 1598 that the Spanish succeeded in establishing a permanent occupancy. Even this was upset by the Pueblo Indians revolt in 1680, after which the Spaniards reestablished themselves by 1697. During this whole period from 1540-1697 a great dislocation of Pueblo populations took place and, whereas there had been seventy or more villages in 1540, by 1700 there were thirty or less. Despite prolonged contacts with the Spaniards and later with the Americans, the Pueblo Indians maintain their cultural identity and particularly their religious independence.

During the Pueblo IV period of Anasazi development, Athabascan-speaking people began coming down from the country to the north. These people had a hunting and gathering economy and, doubtless, a fairly simple cultural development. Some of these Athabascans, the present-day Apaches, moved south of the Pueblo area. Others, the Navajos (Navahos), settled near the Pueblo towns and learned such things as farming and weaving from the Pueblo people, although it should be noted that the Navajo women did the weaving instead of the men as among the Pueblos. The Navajos also took over a great many external aspects of Pueblo ceremonialism to which they gave their own meanings and emphasis. The Navajos may also have acquired the idea of clans, groups of relatives tracing their descent through either the male or female parent, from the Pueblos. The

basic pattern of Navajo social grouping remained, however, the same. They continued to live in large, thinly-scattered family groups which differ completely from the compact Pueblo village group. They also continued to depend on hunting and, after the Spaniards introduced sheep into the Southwest, they developed a greater dependence on herding than did the Pueblos. Like the Pueblos, the Navajos learned to work in silver from the Spaniards.

Nowhere else in the New World were native cultures as undisturbed by the arrival of the Whites as in some parts of this Southwestern area. An amazing proportion of native Pueblo, Navajo and Apache culture was able to survive first Spanish and then American conquest. As a result, these groups have been a rich source of information about and insight into the life and culture of non-European people.

It seems probable that the Hohokam culture of southern Arizona was a development from the very early Cochise culture which was described in an earlier section. As for its subsequent growth, there are no tree rings dates for the desert area of this Hohokam culture, but cross-ties show that its development paralleled the Basket Maker-Pueblo in time. Hohokam culture is described in four stages. Agriculture and pottery-making were known in the earliest stage; the earliest projectile points were for bow and arrow; they had no masonry construction but did build dug-out ball courts in which a ritual game, known as far south as the Maya, was played. The Hohokam also had pyrite mirrors and copper bells similar to some known in Mexico. The Hohokam built irrigation ditches and their early houses were of post and brush construction. During their final developmental period the Hohokam were considerably influenced by contact with the Pueblo III and IV people, and they adopted such traits as common-wall houses of packed earth which they substituted for Pueblo masonry. When the Spaniards first reached southern Arizona in the early part of the 16th century, they found the Pima and Papago Indians living a life similar to but simpler than the classic Hohokam pattern. Their scattered house, built in pit-house style; canal irrigation; pottery made by paddle and anvil and painted red-on-buff; effigy vessels; and cultivation of cotton are so similar to the Hohokam culture as to suggest descent from that group.

The Mogollon culture, like the early Hohokam, was probably a development out of the later stages of the Cochise culture. In the earliest Mogollon period, about the beginning of the Christian era, agriculture was already practiced and pottery was made. Recent evidence indicates that these people began cultivating corn several centuries earlier, at a time before they made pottery. From the 1st to 11th centuries A.D. Mogollon culture showed a fairly uniform pattern with minor variations and developments. After about 1050 there is evidence of strong Anasazi influence either through contact or invasion. There is also evidence of Hohokam influence.

South and west of this core area of Southwestern cultural development are the Uto-Aztecan- and Yuman-speaking people of Southern California and Sonora. Their culture seems to be a simple version of the Hohokam type. In this group belong the Yaqui, Maya, Yuma and Mohave.

Intermediate.—This region, consisting of California and the intermountain area between the Rockies and the coastal mountains, was one of slow development and little change. The California portion of it includes the southern California desert, the broad valley and pine-covered mountains of central California and the densely forested northern part of the state. The earliest cultural material known from California comes from campsites along Lake Mojave (Mohave) and Pinto Basin in the southern California desert and at Borax Lake in central California. The same problem obscures the dating of all of these sites. On geological grounds their age might be the last pluvial period which ended about ten thousand years ago. Or, it may have been during a wet period which occurred about 1000 B.C. The later date seems more acceptable on archaeological grounds. California culture was quite similar to the pre-farming, pre-pottery culture of the Basket Maker people and remained so even until recent times. Because the food supply was ample and the climate was mild, the density of population was high even in the parts of California which had a nonagricultural economy. Cultural development remained on a fairly simple level with evidence of considerable local specialization.

The most extensive cultural subarea was in central California. Here subsistence was based on fishing, hunting and the gathering of wild seeds, particularly of acorns. Acorns formed the chief vegetable food and were made into bread by a complex process which eliminated their tannic acid. The houses of this area were simple brush or tule shelters, or lean-to structures made of poles. These people made no pottery but did make excellent baskets which were used for carrying water and food, for storage, and for cooking by the stone-heating method. Social and political organizations were rudimentary in this area. The religious development was very simple, consisting of a few ceremonies. Shamanism was quite important. An interesting characteristic of this area is the large number of languages spoken in a small area.

To the south of this central area the basic pattern did not change much except for the important addition of pottery-making, and a great increase in linguistic homogeneity. This was an area of a large group of Yuman- and Shoshonean-speaking peoples. North of the central area the contrast was more striking and resemblances to the Northwest Coast area appeared. Fishing was of major importance, a variety of sea foods was consumed along the coast and salmon was the major food along the interior rivers. The construction of plank houses, the use of wood and elk horn for boxes and spoons, and also the increase in carving and decoration all suggest northern affiliations. The same was true of the more elaborate social organization characteristic of this subarea.

The Intermountain area consists of the Great Basin and the Columbia-Fraser Plateau regions. The Great Basin area, lying between the Rockies and the coastal ranges, was one of simple culture based on gathering wild foods. In this respect and also in basketry and house types, Great Basin culture resembled that of California. However, in terms of climate, vegetation and early development the Great Basin is closer to the Southwest. The seed-gathering, basket-making characteristics of the Great Basin are the

same as those described for the Basket Maker people of the early period in the Southwestern area. Lovelock Cave in central Nevada had an Atlatl-culture similar to Basket Maker. Material similar to the early Pueblo periods has been found as far into the Great Basin area as the Utah-Idaho line and the Nevada-California boundary. At an early period California, the Great Basin and the Southwest had common characteristics. The Southwest area surged ahead to a very full development. California managed a few cultural achievements. The Great Basin succeeded only in preserving its simple, early level.

Indians of the Columbia-Fraser Plateau region lived by hunting, salmon fishing and gathering berries and roots, especially the camas. The abundant salmon supply allowed a fairly dense population to live in the dry Middle Columbia region. Archaeological evidence of early cultures is lacking. The material from more recent times suggests that the fairly simple culture known for the early historic times had already been in existence for several centuries or, perhaps, longer. Pottery was not made in this area, but basketry was well developed and bags, mats and clothing were woven of bark fiber. Clothing was also made of deerskin. The largest social unit in the Plateau was the village. A number of villages were grouped together through sharing common dialect and customs, but there was no political structure to tie them together into a tribe.

About the year 1720, actually before the beginning of the historic period in this area, the southern and eastern Plateau tribes were strongly influenced by the adoption of the horse and other culture traits from the Indians of the Plains to the east.

Northwest Coast Area.—The river mouth, coastal and island region stretching from Oregon to the Alaskan border forms the Northwest Coast area, one of the most distinctive in the New World. Life in this area centered around fishing in rivers, in bays and other protected salt water areas, and also in the open sea. Archaeological material is spotty for this area. However, from a comparative study of the recent cultures it seems likely that the people first lived on the rivers and later on the beaches. Finally some, especially in the north, took to the sea and the archipelagos. The tribes included in this area fall into three groups from north to south: (1) the Tlingit, Haida, Tsimshian; (2) Bella Coola, Kwakiutl; (3) Nootka, Quinalt, Salish, Chinook, Tilamook, Yurok, Karok and Hupa. The most northerly groups showed the greatest cultural development. The Indians of this area were skillful and ingenious in their use of wood and in basketry and weaving. The Chilkat, a Tlingit tribe, wove blankets of goat hair by means of a warp suspended from a bar. All the tribes of this northern group built large dugout canoes and the houses of their winter villages were built of cedar timbers and split planks. They also made slat armor, boxes, and dishes of wood, and such ceremonial equipment as rattles and masks. They are, of course, renowned for their elaborately carved totem poles and house posts, covered with symbolic animal decorations. Their baskets were very well made. Pottery and metal-work were unknown. An interesting quality common to the techniques and style of decoration of all their work is its own force and its complete dissimilarity from anything around

it or, for that matter, from anything in the New World.

The Northwest coast tribes also had a distinctive development of economic, social, and ritual organization. There was a great emphasis first on accumulating and then on distributing wealth in the form of food, dentalium-shell currency, slaves, and sheets of native copper. This distribution took place at huge feasts called potlatches which were given to celebrate important events in the life of the individual, such as naming, coming of age, marriage, assuming chiefly office, and death. This Northwest Coast culture is clearly different from anything else in the New World. It was, of course, too far from the Meso-American high culture area to have been influenced by it. A number of Northwest Coast traits show resemblances to traits known in Asia. Slat armor is known from as far away as eastern Asia. The emphasis on wealth as a basis for social status and the use of carved masks are suggestive of Indonesia and western Oceania.

Eskimo Area.—The Eskimos live on the long stretch of Arctic coast from southern Alaska, across the whole of northern Canada to Newfoundland and on the west coast of Greenland. Linguistically, this entire area is covered by one family, also called Eskimo. In physical characteristics the Eskimos differ somewhat from the American Indian proper. They represent a branch of the primary Mongoloid stock known as the Arctic Mongoloid. Archaeological work in the Eskimo area has established a sequence of cultural developments but, so far, has not succeeded in establishing any definite dates. The earliest material is possibly from around 400 A.D. or may be as old as 1 A.D. Relationships with northeastern Asia were strong in the early stages while some later developments were local. Eskimo culture represents a fascinating and remarkable adaptation to an extreme environment. The coastal Eskimos live, for the most part, by hunting seals, walrus and whales. Inland, the caribou are hunted for their meat and fur, both by coastal groups who move inland during the summer months and by a few Eskimo groups which spend the entire year in the caribou country. Other specialties are river salmon fishing in some delta areas and large whale hunting at Point Barrow. The Eskimo's equipment is made from the few materials available. The seal is not only a source of meat but also provides skin for clothing and boats as well as blubber for cooking and heating fuel. The Eskimos make two kinds of houses, both quite small and compact. The winter house is made of rocks and slabs of stone. The snowhouse, or igloo, used on trips, is made of blocks of ice which, because they spiral into a dome, support each other. The igloo serves as a permanent winter house in areas of extreme cold where blowhole fishing is done through the ice of the frozen bays. In most parts of the Arctic coast, wood is lacking or very scarce and is used only for sled runners and for thin boat frames. At the southern extremes of their territory the Eskimos use driftwood for building their houses. In some areas where wood is lacking whale ribs are used as roof supports. Eskimo boats are of two kinds. The kayak is a one-man hunting boat, decked over except for the hunter's seat. The umiak, which is open and larger, is used for transportation and for whaling. The Eskimos of the Aleutian Islands and the Pacific coast area lived in villages, but elsewhere

they lived in scattered family groups. There were no tribal groups in the sense of a political organization but only in a geographical sense, indicating a group showing some cultural and linguistic uniformity.

Northern and Eastern Area.—The North American continent east of the Rocky Mountains and north of Mexico shows considerable environmental uniformity despite its great size and its wide range of latitude. Temperature range and precipitation are quite similar throughout the area. The whole eastern part is evenly covered with forest which to the west changes gradually to parkland and to the open grassland of the western plains. This environmental uniformity was reflected in a considerable degree of cultural uniformity. There were, of course, varying local adaptations, but during the pre-Caucasian period these did not reach any degree of intensification.

The prehistory of this area may, from present archaeological evidence, be seen as a sequence of four stages: Pre-pottery, Woodland, Hopewell, and Mississippian. Pre-pottery period sites are known from Massachusetts, New York State, the lower Ohio drainage, the Ozarks, the Mississippi delta, Florida, northern Texas and western Nebraska. These sites were also all pre-agricultural. The oldest of these sites are Clear Fork in Texas and Signal Butte in Nebraska. A date of 2000 B.C. is claimed for the latter. In any case, this eastern pre-pottery period extended back from the early centuries of the Christian era and may be as old as 3000 B.C. in some places. The Woodland period grew, largely, out of the pre-pottery period with the introduction of pottery-making and, perhaps somewhat later, maize agriculture. In some areas the Woodland culture persisted for a very long time while in other places local cultural developments grew out of it. Woodland pottery was cordmarked, a characteristic which can be traced northwestward to Asia and even resembles European Neolithic pottery. The implications of this resemblance are far from clear. The Woodland people also made smoking pipes, stone axes and chisels, and the so-called "banner stones" and "bird stones" of well-polished slate. Sites of this period are known from New England, Ohio, Illinois, Wisconsin, Kansas, Nebraska, and North Dakota.

Sites from the Hopewellian period are scattered along the Mississippi and its principal affluents, and also across the Gulf Coast to Florida. The highest accomplishments in eastern prehistoric art are from the Hopewell sites in southern Ohio. Particularly noteworthy are human and animal sculptures in stone, bone, and clay, elaborate curvilinear designs incised on pottery, large, finely chipped blades of obsidian and quartz crystal, and celts and elaborate ornaments of copper. It has been debated whether such Hopewellian traits as burial mounds, the accumulation of wealth, and the presence of chiefs were indications of importation or influence from Mexico. Because the greatest development occurred in Ohio, at the point farthest from Mexico, it seems likely that the Mexican influence was indirect.

The Mississippian period is known primarily from sites south of the Ohio River and east of the Mississippi plus some from Texas, Arkansas, and Oklahoma. Pottery from the later part of this period in Texas crossies with Pueblo pottery, giving a date of 1300-1450 A.D. During the Mississippian period mounds were built which

served as the bases for temples. Very fine work was done in modeled and engraved pottery, and with shells and copper. The question of Mexican influence arises again here. Mexican motives may be found, especially in material from the southern states. There was, however, clearly a development from the Hopewell period.

Turning to later cultural conditions in the Northern and Eastern Area, some regional variations appear. In the Northern area of coniferous forest reaching across the continent from Newfoundland to Alaska, farming was impossible and the wild game was thinly scattered. As a result, the population was also thinly scattered and cultural development meagre. The caribou, which ranged clear across this area, was the major source of food and also supplied material for clothing and tents. Other traits characteristic of the area are: spruce and birchbark canoes; toboggans; babiche and bark fiber; the use of snares and nets; cooking with hot stones in baskets made of split spruce root. The tribes of this area camped along the rivers traveling by canoe in summer and on the ice in winter. They were independent of each other, having no tribal political systems. There was also little religious activity except for the prominence of shamanism. Hudson's Bay constitutes a dividing line within this area. The tribes to the east of it are the Algonquian-speaking Saulteaux, Cree, Montagnais, and Naskapi, all of whom share the basic pattern of this area. To the west of Hudson's Bay were the Dene whose culture was similar to the more easterly groups with the addition of some influences from the Eskimo on the one hand (kayak, some fishing implements), and from the Northwest coast tribes on the other hand (social classes based on wealth, clans, the potlatch, use of armor). In this area there is also salmon fishing and some use of planks for houses as well as the tipi and lean-to.

The next subarea within the Northern and Eastern Area is the Eastern Woodland Area which consists of three principal groups: (1) the Iroquoian tribes (Huron, Wyandot, Erie, Susquehanna, and the Six Nations); (2) the central Algonquin, lying west of the Iroquois and including the Ojibway, Ottawa, Menomini, Sauk, and Fox, Potawatomi, Peoria, Illinois, Kickapoo, Miami, Shawnee, and the Siouan Winnebago; (3) the eastern Algonquin including the Abnaki, Micmac, New England tribes, and the Delaware. Because so many of these tribes became extinct early in historic times, the details of their culture are not too well known but the following traits are characteristic: cultivation of maize, squashes and beans; the use of wild rice and maple sugar where available; hunting of deer, bear and buffalo; fishing on the lakes; some pottery cooking vessels; also vessels of wood and bark; splint basketry; a winter bark or mat-covered lodge and a summer rectangular bark house; the use of canoes, toboggans and snowshoes; skin clothing for men and women. The two eastern divisions were more intensive agriculturalists and made more use of pottery. The Iroquois did superior work in bone and in carving wooden masks. They also had a highly developed political organization, typical of an eastern pattern of confederacies which reached its final development in late pre-white times. The best-known of these confederacies was the Iroquois League of the Six Nations, which included the Mohawk, Oneida, Onondaga, Cayuga, Seneca,

and Tuscarora. It seems certain that these large leagues developed out of a native pattern of small and unstable leagues. It also seems clear that the full development of these early leagues took place only after the pressure from white encroachment made a strong organization necessary and the acquisition of such Caucasian possessions as livestock and firearms produced a temporarily more stable economy.

The Southeastern subarea covers the region east from the Mississippi. It includes such tribes as the Natchez, Powhatan and Shawnee, all the Muskogean groups (e.g., Choctaw, Chickasaw, and Creek), the Eastern Siouan (Ofo and Biloxi), and the Cherokee.

This was an area of intensive agriculture. Maize, pumpkins, melons, and tobacco were raised before White contact and fruit trees were quickly taken over from the Europeans. Dogs were the only pre-European domestic source of food but chickens, hogs, horses and cattle were quickly adopted. Deer, bear, bison, turkeys and other small game were hunted wherever available. The houses in this area were usually covered with thatch or bark, and sometimes had plaster walls reinforced with wickerwork; towns were fortified with palisades; clothing was made of deer-skin, weaving was done with bark fiber and buffalo hair; fine mats were made of cane and some work was done with cornhusks; some special kinds of baskets such as the double basket and basket meal sieve were made; knives and darts were of cane; the blowgun was used; pottery was well made by the coil process with paddle decorations; there was no metal work or sculpture but some stone work. In some places temples, set on mounds, were used in sun worship; there were also elaborate rituals for planting and harvesting, and the political chiefs were considered to be under the sacred power of the Sun God. Strong confederacies were developed in this area, and there was a clan system and a society composed of chiefs and four classes of subjects.

The Plains subarea stretched from Texas to Saskatchewan and included the low plains or prairies on the east and the high plains along the foothills of the Rocky Mountains. It included such tribes as the Assiniboin, Arapaho, Blackfoot, Cheyenne, Comanche, Crow, Gros Ventre, Kiowa, Kiowa-Apache, Sarsi, and Teton-Dakota. The typical economy of the whole area was dependence on the buffalo and a limited use of roots and berries. There was a great development of work in skins, no basketry or pottery, and very little use of wood or stone. The typical dwelling was the conical skin tent or tipi. Social organization consisted of a simple band organization and a series of men's societies. The most important ceremonial observance was the Sun Dance but there were also minor ceremonial occasions. Within this general pattern were local variations. The tribes on the eastern border practiced agriculture, made some pottery and basketry, and performed agricultural ceremonies in place of the Sun Dance. They also had permanent houses covered with grass, bark or earth. The tribes on the western border depended more on deer and small game and less on the buffalo; they also made use of wild seeds and grains, and had brush and mat-covered shelters as well as tipis. They made good basketry but no pottery.

For the Plains area as a whole the period of florescence came with the introduction of the

horse by the Spaniards in the 17th century. Before that, the farming tribes along the eastern border and some tribes in the foothills of the Rockies penetrated into the Plains but permanent occupation was sparse. Once the use of the horse had been mastered, the Indians could move into the Plains and exploit the buffalo more effectively. Some tribes, the Teton-Dakota and Cheyenne, for example, are known to have given up farming and taken to the life which developed into what is thought of as typical Plains culture. The final development was an elaboration of the basic pattern. Plains life centered around the buffalo which was the chief source of food, material for clothing, shelter, tools and medicines. The use of the horse enabled the Indians to capture enough buffalo to support them. The typical social group of the Plains was the band, several of which constituted the tribe. The bands of a tribe assembled at the beginning of summer to perform the Sun Dance, which was a tribal ceremony thought to ensure good hunting and the general welfare. There followed one or more tribal buffalo hunts, after which the bands dispersed and passed the remainder of the year separately. Since inter-tribal warfare was waged mainly in summer, the gathering of the bands in this season was also a measure of defense.

THE CONQUEST AND AFTER

The story of the American Indians after the time of the conquest is, for the most part, one of sudden and violent change which contrasts strongly with the slow, gradual centuries of pre-conquest development. Meso-America and South America were the first victims of the conquest. The arrival of Cortes in the Aztec capitol, Tenochtitlan, in 1520 and of Pizarro in the Inca capital in 1532 initiated the same series of struggles which ultimately took place over most of the New World. The balance was, to say the least, uneven. Numerical superiority was the only advantage on the Indians' side, and this was greatly outweighed by the firearms, armor, horses and training of the Spanish soldiers. The people who reached the New World in the period of Conquest were the soldiers, priests, fortune-seekers and colonists from several different European nations. They came from Spain, Portugal, Holland, France and England for a variety of reasons: for the sake of conquest, immediate exploitation, religious conversion or settlement. The variety of their purposes on the one hand, and, on the other, the varying nature of the Indian groups encountered, meant that the effect of the arrival of the white men differed, somewhat, from one area to another. The results depended on such factors as density of native population, suitability of the area for the new types of land use, and the susceptibility of the natives to the diseases introduced by their conquerors.

In the Marginal and Tropical Forest areas of South America, the Indians living along the coast and the navigable interior waterways were quickly absorbed or exterminated. In the less accessible parts of these areas, the natives first experienced an indirect contact with Spanish culture. They received new crops, domesticated animals and some tools and weapons before having actual contact with the whites. Among some tribes this led to an improvement in their exploitive activities and an expansion of their native culture. With the added advantage of

the horse for hunting and packing, the tribes of the Pampas and Patagonia could exploit larger areas. Later, after their first direct contact, whether the white settlers were missionaries or colonists, the natives were gathered into settlements where their native culture was quickly lost and the natives themselves were exposed to decimating epidemics. In the Circum-Caribbean area, the Indians of the Antilles and of the coast and lowland areas were exterminated or absorbed very rapidly by disease and enslavement. In the less accessible regions, such as the mountains, the native culture survived, but with a loss of such distinctive characteristics as its class system, organized warfare and special craft production.

In the Andean area, also, the native population suffered a great initial loss. At the time of the conquest in 1532 the Inca Empire (Andean region from northern Ecuador to northern Argentina and northern Chile) contained about four and a half million Indians. By 1571 this number was reduced by more than half, and by 1796 there were less than a million Indians in the area. After the wars of independence in the 19th century, the Indian population again increased until, today, in the old Inca area of highland Ecuador, Peru, and Bolivia, there are five and a half million Quechua-speaking people, and in the Lake Titicaca area, 500,000 Aymara-speaking people.

The population of this Andean area is today one of the two instances of very high proportion of Indian individuals in the New World. Except for Paraguay and the remote tropical forest of the upper Amazon, the populations of the other South American countries are largely white and mestizo with some Negroes and mulattoes in Brazil. During the years after the conquest, the Indian population of the Andean area tended to concentrate in the highlands, leaving the coastal section for the Spanish and mestizo population. This is quite apparent today in the contrast between the colorful and vigorous highland people and the somewhat somber and pallid coastal population. The native Andean crops and system of agriculture continued in use. The Spaniards did introduce barley and wheat but these were never widely accepted. The Indian methods of terracing and irrigating persisted, and the use of the Spanish wooden plow and of oxen as draft animals were introduced. The chief Spanish contribution to subsistence was their domesticated animals, the pig, chicken, burro, horse, cattle, sheep, and goats. These were added to the native use of the llama and alpaca. The introduction of Catholicism was so swift that by 1650 the Andean area was officially considered to be Christianized. The native religion was wiped out and only a few simple rites and ceremonies survived. Along with the loss of native religion went a great change in native craftsmanship. Ceremonial objects, which had constituted a large part of their craft output, were no longer needed. The native techniques persisted in the making of some utilitarian objects. The old belt looms are used as well as the European treadle loom. Sheep's wool is used as much as llama wool. Metalwork has all but disappeared but wooden bowls and woven baskets and mats are still made. The pottery is coarser than the pre-conquest ware and poorly decorated. It is made, for the most part, by the old techniques although the potter's wheel is now also used. Indian houses are made in much the same way as before

but the large, public buildings were, of course, planned by Spanish architects. It is of interest to note in this connection that in the 1950 earthquake in the Cuzco area, the Spanish structures collapsed but the old Inca buildings survived. Most Indians of the Andean area continued to practice farming after the conquest, living in scattered, independent villages. Some are peon laborers on large haciendas, but many own their own land and live in communities which have many characteristics of native culture. In Peru and Bolivia there are 3,000 such communities of about 500 persons each. Every year, education and increased transportation facilities bring these rural areas into closer contact with the white, urban culture. Bilingualism is increasing, and gradually the native culture is being lost in the process of assimilation into the national culture.

In Meso-America the conquest began with the landing of Cortes and his soldiers at Vera Cruz in 1519. The Aztecs resisted bravely but in vain, and their emperor, Montezuma II, and thousands of their people were killed. Cortes then extended his conquest to Honduras and Guatemala. In Meso-America as in Peru a profound change resulting from the conquest was the imposition of the Spanish land-use pattern. This was a system of large estates worked by mass labor and was in complete contrast to the native system of communal lands allotted to individuals. Even in the case of such native empires as the Aztec and Maya (also the Inca in Peru), the trading and collecting of tribute which had brought widely scattered groups into contact had not done so at the expense of the local communities. In terms of items added to the native Meso-American culture, the Spanish introduced the burro, cultivation of wheat, sugar cane, coffee, potatoes and bananas. The use of money largely supplanted trade by barter. Iron tools, the plow and cart were added, and later the sewing machine, power corn grinder, and factory-woven cloth. In most communities pre-conquest deities and communal agricultural ceremonies were replaced by Catholic Church fiestas, and the cult of the saints replaced local and family deities. The native pattern in which religious and secular functions were combined has, of course, been replaced by one in which these functions are entirely separate.

The Indian population of Guatemala and Mexico has more than regained its aboriginal size. The estimated population for the two countries in 1500 is about three million people. In 1940 there were six million in Mexico and nearly two million in Guatemala. In proportion to the total populations of these two countries, 33 per cent of Mexico and 55 per cent of Guatemala is Indian. These figures are based on a definition of the word "Indian" in cultural rather than biological terms. That is, when natives have adopted the Spanish language, European clothing and other traits, they are no longer classified as Indians but as mestizos (mixed-bloods) even though they may be Indians racially. The proportion of individuals figured on the basis of Indian descent would be much higher than the proportions given. This classification of Indians on a cultural rather than racial basis reflects an attitude in which South and Meso-America differ from North America. In South and Meso-American countries a person is classed by his culture and not by his race. An Indian is a person with Indian culture; a Negro is a person

with African culture, a white has white culture although not necessarily a white skin. This results in great racial and social fluidity. A person who is born an Indian, may, by education, by occupation and by acquisition of white modes of dress, speech and living, actually become a white. Also, two men who are brothers may be classed differently, one as an Indian, the other as a white. The vast majority of Indians, as well as of Negroes, in these countries still have their native cultural background which limits their ability to compete in the national, white culture. Nevertheless, the social fluidity allows individuals of special ability to achieve any status within the national culture. Indians and Negroes alike have made significant contributions as artists, doctors, lawyers, writers, and legislators. Another result of this fluidity is the emergence in some South and Meso-American countries of local cultures which are a blend of Indian and white elements. The cultures of such groups as the Guarani of Paraguay, the Ladino of Guatemala and the Criollo of Argentina are blends and although part of the national culture also preserve distinctive Indian characteristics.

A further fundamental difference in the post-conquest patterns in South and Meso-America as contrasted with North America, is that North America became urban and industrialized, whereas South and Meso-America have remained essentially agrarian and have retained to a considerable extent the pattern of large landholders with masses of native laborers. The present situation of the Indians under these circumstances is difficult. Those who have no land live in communities on the haciendas; those who have a little land may attempt to cling to community life and native patterns; and those who have enough land are able to produce a cash crop but still retain the old, local patterns of life. Whatever the Indian's situation, and whichever adjustment he may attempt to work out, the transitional phases are characterized by economic and cultural instability requiring special consideration to help him achieve a constructive and permanent solution.

It is of interest to notice that the areas of present-day concentration of Indian population were pre-conquest areas of population density. Nine-tenths of all American Indians live in the highland countries of Meso-America and South America which were early centers of high cultural development and dense population. The Spanish cultures added some new items to the content of these native cultures, but there was not a great disparity in the wealth of culture content and much enrichment also flowed from Indian to Spanish culture. Because, in these areas, neither culture completely engulfed the other, a blend emerged which could not have occurred under circumstances of great cultural disparity.

North of Mexico the pattern of settlement differed from that in Spanish America. The colonists arrived, on the whole, in family groups, settled and worked as families. In the eastern United States and Canada they found an area of low population density. Some of the Indian tribes of the eastern United States experienced a temporary period of expansion when, by indirect contact with the whites, they received some new plants and animals. But when contact became direct, the natives' tribal economy and the villages on which their social life was based were destroyed and it was not long before the Indians themselves were virtually extinct. The

settlers wanted land and had little difficulty in conquering the Indians or pushing them westward until they reached the submarginal lands unsuited to white settlement.

It has been noted in an earlier section that the major development of the culture of the Plains Indians came as a result of their receiving the horse which had been brought to the New World by the Spaniards. This period lasted as long as the white man did not want the territory of the Plains Indians. After that came some of the bloodiest Indian wars and the establishment of the survivors on reservations. The tribes of the southwestern United States were in contact with Spanish civilization as early as the sixteenth century. Those tribes having a fairly advanced culture absorbed some Spanish elements and did not experience cultural disintegration. The Pueblo tribes of the Hopi mesas and of the Rio Grande Valley, and the Navajos and Apaches retained a large part of their aboriginal beliefs, practices, outlook and culture traits. Their ceremonial life is less influenced by missionary teachings and their social organization is less disrupted than is the case with any other New World groups. The Navajos have shown a remarkable increase in numbers. In less than a century they grew from 8,000 to 50,000; a higher rate of increase than that of the white population.

The characteristics of contact, conquest and reservation life are much the same for the Indians in Canada as in the United States. The exception is in the far north where a few partially assimilated tribes live. The largest group is the Eskimos who number about 36,000 (including those in Danish Greenland).

A dominant factor affecting Indians and Indian groups in North America has been the Anglo-American point of view about races and race segregation. This attitude, as we have already seen, was not held by Spanish and Portuguese people. In North America the races represented by the whites, Negroes and Indians have been, by tradition, socially segregated. Each of these groups contains within itself a wide range of occupational and social statuses and an Indian (or a Negro) may rise only within his own group. Because Indians have been physically separated on reservations their situation has been less obvious than that of the Negroes. It is, nevertheless, true that like the Negroes, they are classified on the basis of race and not, as in Spanish America, on a cultural basis.

It is estimated that in 1500, the Indian population of North America was about one million. Of these, about two hundred thirty thousand were in Canada and about seven hundred seventy thousand in the United States. The areas of greatest density were the Pueblo area of Arizona and New Mexico and a portion of central California. The only group which has made any marked increase is, as has been mentioned, the Navajos, who increased from 8,000 to 50,000 between the mid-19th and the mid-20th centuries. The general Indian population decreased. As of 1960, the Indian population of the United States was estimated at 524,000; that of Canada was an estimated 186,000.

The transformation of Indian life was not the only result of the meeting of European and Indian cultures. The white settlers were also influenced by the Indians and borrowed many useful things from them. This Indian influence

has contributed much to the distinctive flavor which sets contemporary New World cultures apart from their parent cultures in Europe. The American Indian added new items to the world inventory of plants and domesticated animals. Among about forty unique plants are food plants such as maize, beans, melons, squash, pumpkins, tomatoes, avocados, white potatoes, chocolate, chili peppers, pineapple, papaya, and manioc (the source of tapioca); and other plants such as rubber, tobacco, chicle, quinine, and coca (the source of cocaine). Among the domesticated animals unique to the New World are the turkey, guinea pig, llama, and alpaca. A few prepared foods are also Indian in origin: maple syrup, tamales and pemmican. Another group of items made by the American Indians and taken over from them includes: the hammock, toboggan, parka, moccasin, dog-sled, canoe, the various ways of smoking tobacco (the pipe, cigar and cigarette), and also the use of snuff. The Indian has contributed richness and color to the literature of North America and of Spanish America.

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MALCOLM CARR COLLIER.

INDIANS, Education of the. Broadly speaking, the education of the American Indians has progressed through four major periods: pre-colonial, colonial, treaty, and posttreaty. For a proper understanding of its status in the 1950's, the subject should be reviewed in relation to the historical setting of each of the periods through which it has passed. Even then, however, the picture could be painted in only the broadest strokes. A more comprehensive treatise would require an analysis of the educational development of each of the approximately 300 Indian tribal groups, because attitudes toward education, opportunities for education, and educational



Sioux Indian girl.



Blackfoot Indian boy: "Bear Medicine."



Cree Indian woman: "White Buffalo."



Cree Indian chief.

AMERICAN INDIANS

Portraits painted from life by Winold Reiss

Right: Studying differences in soils with the aid of a Bureau of Indian Affairs instructor. To help Indians understand and obtain the best results from their soils, the bureau has undertaken a soil inventory program covering 41 million acres of land.

AMERICAN INDIANS

Below: A class of youngsters at a bureau-operated school on the Navajo Reservation. About one third of Indian children attend such federal schools. The rest go mostly to public schools; some attend mission and other private schools.



Above: Navajo students using library at a federal school at Brigham City, Utah. The bureau stresses upgrading of libraries and of students' skill in using them.

Photographs from the Bureau of Indian Affairs



Above: A physical fitness class for girls at the Haskell Institute at Lawrence, Kans., largest Indian school in the United States.

Below: Close play at home plate at the Brigham City school. Baseball, scouting, and camping are popular among Indian students.



achievements vary as the historical conditions surrounding each group have varied. Furthermore, a definitive picture of Indian education in the 1950's would require the paying of some attention to the educational status of the many thousands of Americans who trace their origin immediately or remotely to Indian ancestors, but who have culturally lost their Indian identity.

Precolonial Period.—The ancestors of the American Indians occupied in precolonial times all of what is now the continental United States. The geography of the area in which each group lived largely determined its way of life, and the way of life of the group dictated in turn the educational needs of its youth. The youth of the Indian groups along the eastern seaboard were educated in the ways of the woods. They were taught to hunt and fish in the mountains and streams; to plant crops of squash, beans, and corn in the clearings; to protect themselves from the elements in winter and summer; and to perform the proper ceremonies in order to preserve and perfect their relations to a Higher Spirit. Young people growing up in Indian groups who roamed the prairies were taught the techniques of survival on the open plains—how to hunt the buffalo for food, and how to preserve and cure its hide for clothing and housing. Indians of the Northwest needed the skills of hunting and fishing and seed gathering, while the youth of the arid Southwest were taught how to conserve precious water supplies and to apply them to the raising of crops.

Education in precolonial days was related in a practical way to the needs of each group. Indian youth were informally, though carefully, taught, usually by their parents and grandparents, how to make a living, how to function in relation to other members of their group, and how to relate themselves to a Higher Spirit and to live morally according to the social values of their societies.

Colonial Period.—The white man, when he came to the North American continent, brought with him a pattern of life different in most respects from that of the Indian groups who were living in the areas where he settled. He imported his ideas of education, individual property ownership, religion, agriculture, medicine, and the accumulation of wealth, and conflicts of ideas developed rather quickly. Opposing conceptions of land ownership soon caused a struggle which resulted in some of the bloodiest encounters between the two races. History records the struggle for land from many points of view, but usually the Indian fought valiantly to protect his home and his family, and the white man from his point of view did the same.

The colonists attempted to Christianize and educate the Indian. The central purpose of education for the Indian, as the white man envisioned it, was to replace the Indian's way of life by eradicating completely his beliefs and customs and by substituting for them beliefs and customs of European origin. To achieve this objective, efforts were made to gather the Indians into towns and communities where schools and churches were established to teach non-Indian crafts, civic responsibilities related to township forms of government, and the Christian religion. The first such school was established in Cuba in 1568 by Jesuit missionaries for Florida Indians. John Eliot began in 1646 the development of Indian town communities in Massachusetts, and

by 1674 their number is reported to have increased to 14. Later, Franciscan missionaries in the West and Southwest encouraged Indians to settle around missions, where they were taught husbandry and Christianity. Harvard College by charter in 1650, the College of William and Mary in 1691, and Dartmouth College in 1769 were among the first colleges dedicated to Indian education. Through these and other efforts individual Indians assimilated to varying degrees non-Indian culture, but as a rule the Indians did not respond enthusiastically to the system of education offered. The reasons for the general nonacceptance of formal education could best be stated in the words of an Indian chief in reply to an offer to educate Indian youth:¹

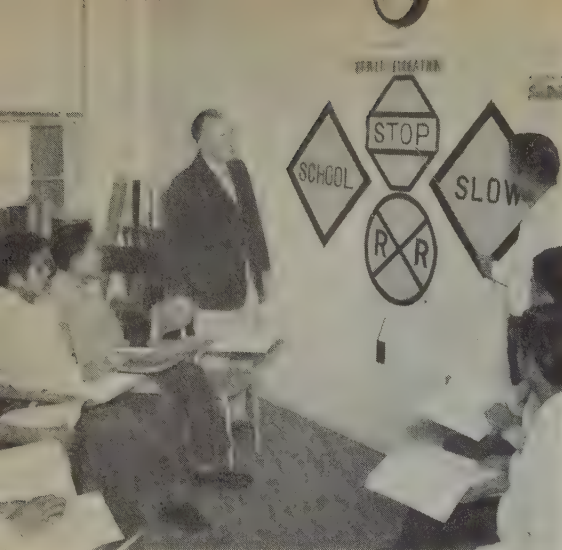
We are convinced . . . that you mean to do us good by your proposal, and we thank you heartily. But you, who are wise, must know that different nations have different conceptions of things; and you will therefore not take it amiss if our ideas of this kind of education happen not to be the same with yours. We have had some experience of it. Several of our young people were formerly brought up at the colleges of the northern provinces; they were instructed in all your sciences; but, when they came back to us, they were bad runners, ignorant of every means of living in the woods . . . totally good for nothing. We are, however, . . . obliged by your kind offer, . . . and, to show our grateful sense of it, if the gentlemen of Virginia will send us a dozen of their sons, we will take great care of their education, instruct them in all we know, and make men of them.

Meanwhile, the impact of the conflict between Indian and non-Indian and the removal of the Indians farther and farther westward engendered a bitterness on both sides that retarded the education of the Indians for several generations.

Treaty Period.—As each group of Indians was conquered, usually, though not always, the conflict was concluded by a treaty between the federal government and the Indian group. In the treaty the government spelled out certain promises, such as tax-free land, and usually, though again not always, the establishment of schools for Indian youth. Regardless of the promises made in such treaties, however, Indian attitudes resulting from war experiences with non-Indians did not favor acceptance of the white man's schools. During this period missionaries made heroic efforts to rebuild Indian morale, but it was difficult for the Indians to reconcile the Christian principles enunciated by missionaries with their recent experiences with non-Indians.

The first formal recognition by the federal government of educational responsibility toward the Indians was an appropriation in 1819 of \$10,000, which was distributed to religious groups to further educational work among Indians. The federal policy of distributing annual appropriations to mission groups to carry on such work among the Indians continued until 1900, the amount appropriated each year increasing to \$611,570 by 1892. Between 1892 and 1900 there was considerable public discussion concerning the schools operated by the different religious societies, and federal policy was changed in the appropriation act for 1897, which declared it to be the policy of the government that no further appropriations be made in support of education in sectarian schools. Funds were appropriated for these schools through 1900, and thereafter the government established and expanded its own system of federally operated schools.

¹Benjamin Franklin in *Two Tracts; Information to Those Who Would Remove to America and Remarks Concerning the Savages of North America*, 3d ed., pp. 28-29 (London 1794).



Courtesy Department of the Interior

Under the sponsorship of the Branch of Education, Bureau of Indian Affairs, special students are given courses in driver education.

The central purpose of education during the treaty period was to Christianize and remake the Indian in conformity with non-Indian patterns of living. Most educators of the time came to believe that the fastest and surest way to achieve this transformation was through boarding school education, which would separate Indian children from their families and surround them with a non-Indian environment. Consequently, great emphasis was placed on boarding schools.

Posttreaty Period.—By the close of the 19th century federal support of sectarian education had been replaced completely by a federally operated system of schools, which was being expanded rapidly through the conversion of abandoned army forts to school use and through the construction of new schools. One example of an army post converted to school use was Carlisle Indian School, which was founded by Capt. (later Gen.) Richard Henry Pratt in 1879 at Carlisle, Pa., and made famous by its athletes. Such celebrated figures as James Francis (Jim) Thorpe and Glenn L. (Pop) Warner publicized the athletic prowess of the student body. In addition, Carlisle became known for its outing system of placing students in Pennsylvania homes, where they lived as members of the family and learned the American way of life. Carlisle was closed as a school in 1918, but in the 1950's many of the older generation of Indians still could recount vividly their experiences at that institution.

During this period several new school plants were built, among them Chillico Agricultural School, in Chillico, Okla.; Haskell Institute, in Lawrence, Kans.; Phoenix Indian School, in Phoenix, Ariz.; Albuquerque Indian School, in Albuquerque, N.Mex.; Hayward Boarding School, in Hayward, Wis. (now closed); and Pipestone Indian School, in Pipestone, Minn. (also closed). In addition, a few day schools were established. Emphasis was placed on boarding school education, however, primarily in the belief, which continued to persist, that the most effective way to educate Indians was to remove children from an Indian environment and to surround them with a non-Indian way of life. Con-

sequently, boarding schools were established away from the homes of Indians, usually near some urban center.

Indians did not respond willingly to this method of education. By various means they were induced or compelled to send their children to school, but usually the Indian family selected one child who attended school as a duty to be met in the name of the family. Emphasis was placed on instruction in English, husbandry, and domestic arts. Some of the boarding school students of the period never returned to their homes. A number who did return to their reservations became confused by the conflict between the two ways of life, while others were soon submerged once more in Indian life, although many later emerged as tribal leaders after attaining the maturity required for Indian leadership. Judged in the light of mid-20th century educational methods and standards of instruction, the harsh methods of punishment of the period, especially punishment for speaking native languages, and the strict military discipline and atmosphere that typified the school administration must be condemned.

An act of Congress of 1924, commonly known as the Citizenship Act, marked a major turning point in Indian affairs and had an extremely important relationship to Indian education. This act, which conferred citizenship on all Indians within the continental United States, gave them the right equally with other citizens to look to state and local governments for educational services. This posed serious problems for the states, primarily in two respects: (1) The nontaxable status of Indian lands resulted in the inability of many local public school districts to assume financial responsibility for the education of Indians. (2) Much Indian land had never been included in school districts.

Although the federal government realizes that education is a state responsibility, it recognizes that states and local districts must have an adequate financial base in order to operate schools. In districts deprived of sufficient financial resources to operate their schools because of the presence of nontaxable Indian land and of large numbers of Indian children to be educated, the Bureau of Indian Affairs therefore makes a financial contribution under the authority of the



Frederic Lewis

Carpentry is one of the many useful crafts taught at the United States government Indian school, San Ildefonso Pueblo, New Mexico.

INDIANS, EDUCATION OF THE

Johnson-O'Malley Act of April 16, 1934, as amended, in order to permit the schools to operate under adequate standards. Public Law 815 of Sept. 23, 1950, as amended, which is administered by the Office of Education, Department of Health, Education, and Welfare, has speeded the process of placing Indians on the same educational footing as other citizens by providing financial assistance for school construction in Indian areas. In the fiscal year 1957 the Bureau of Indian Affairs provided assistance to needy school districts through contracts in 19 states and the Territory of Alaska.

During the Hoover administration, Hubert Work, then secretary of the interior, engaged the Institute for Government Research of Washington, D.C., to make a searching study of Indian administration, including Indian education. As a result of this investigation, the findings of which were published in 1928, Indian educational policy was radically changed, and the approach was reversed from one of removing Indians from their homes to one of educating Indians within their home environment. This permitted the school to become an important agent of change, its learning leavening and advancing the entire group, adults as well as children. The newer approach of education probably did more than any other single factor to reverse the negative attitude of Indian parents toward formal schooling for their children. The newer policy was reinforced by congressional action outlined in the Indian Reorganization Act of 1934. Consequently, many boarding schools were closed, and day schools were established to replace them. The new day schools became community-centered institutions emphasizing the education of both children and adults. Their programs were developed around the needs of the group they served, which included health, sanitation, community and home improvement, stock improvement, recreation, and the like. Through these community schools, Indians acquired new ideas, which led to fresh ambitions and improved living standards. These schools began to dissolve the psychological boundaries that set Indians apart and to motivate them to seek opportunities beyond the reservation boundaries.



Ewing Galloway

The curriculum of the Ganado Mission High School, in the heart of the Navaho Reservation, includes electric mimeograph operation.



Wide World Photos, Inc.

Willard Spotted Horse, a 20-year-old Crow Indian, learns the welder's trade at Haskell Institute, Lawrence, Kansas.

Because of geographical factors of isolation, however, it was impossible to eliminate all boarding schools. In many areas, Indian populations were so scattered that such schools were the only means of providing education. When no other educational plan was feasible, boarding schools on reservations were retained, but their curriculums were revised to conform to the new educational policies.

Educational Programs.—Thousands of American Indians have lost their cultural identity as Indians, and function fully as citizens on the same basis as non-Indians in their respective communities. Of the 142,000 Indian children of school age whose parents still retained in 1957 some degree of relationship to the federal government because of federal trusteeship over Indian land, 60.7 per cent were in public schools, 30.5 per cent in federal schools, and 8.8 per cent in mission and other schools. Of those attending federal schools, 82.6 per cent came from fullblood families in which the Indian language was usually that spoken in the home.

In 1957 the Bureau of Indian Affairs operated 95 boarding schools of all types and 229 day schools; of these, 26 were operated as fully accredited high schools. In addition to the fundamentals ordinarily taught, the curriculum of the

federal schools gives special attention to instruction in communication skills, vocational and homemaking skills, and the social skills important in successful adjustment to modern living.

Higher Education.—The Bureau of Indian Affairs encourages Indians to pursue post-high school courses, both college and trade, and provides assistance through limited federal grants and federal loans. It also encourages Indian groups with the financial resources to do so to establish scholarship programs. In 1957, 23 tribal groups were operating scholarship grant programs and 67 were making loans for education and other purposes. The Jicarilla Apache and the Navajo tribes have set aside \$1,000,000 and \$5,000,000, respectively, and use the income from these funds to provide grants for the higher education of their youth. In addition, some states provide scholarships for Indian residents.

This accelerated emphasis on financial aid for higher education has led to the enrollment of greater numbers of Indians in colleges and universities. In 1957 approximately 2,800 young Indians were in schools of higher learning and many of these were receiving financial assistance from various scholarship programs.

Adult Education.—The Bureau of Indian Affairs initiated in 1956 a pilot program of adult education for Indians who had failed to obtain formal education in their youth. Geared to the literacy needs of these groups, this program aims to impart a workable knowledge of English and to develop the fundamental skills and understandings necessary for living in a modern world. Emphasis is placed on the development of basic understandings in the management of money, time, and family responsibilities required

Navaho and Alaskan Education.—The largest remaining federal operation in the 1950's was concerned with Indians in the Southwest and in Alaska. Recency of educational opportunities for these groups made continued federal operation necessary.

Although as late as 1946 only one Navaho (Navajo) child in four had an opportunity to attend school, a combination of factors—the location of a few day schools among the people, the impact of World War II, and a diminishing resource base—resulted in a radically changed point of view on the part of the Navaho Indians during the succeeding decade. In 1953 the federal government declared the out-of-school situation on the Navajo Indian Reservation an emergency and instituted emergency measures to place all Navaho children in school. Temporary facilities and trailer schools were located on the reservation, existing reservation schools were expanded, and facilities were developed in public schools nearby. This all-out effort reduced the out-of-school Navaho population of school age from 13,000 in 1954 to approximately 3,000 in 1957.

Schools for the native children of Alaska—Eskimos, Indians, Aleuts—are operated under two systems, a territorial system and a federally operated system. Federally operated schools were established in 1884 by the Office of Education and in 1931 were transferred to the Bureau of Indian Affairs. As of 1957, 11,426 Alaskan native children were enrolled as follows: federal schools, 4,558; territorial schools, 6,144; mission schools, 724. A total of 84 federal schools were operated, 2 of them as boarding schools and the remainder as day schools in native villages. Native children attend one federal high school and several territorial high schools. The best estimates indicated that there were approximately 1,200 pupils in Alaska without facilities in 1957.

Organization.—Indian educational policy is developed by the commissioner of Indian affairs and his staff, technical assistance being provided by trained educators. The program of education is administered through a decentralized system of 10 area offices, each headed by a director responsible for the administration of all programs within his area, including education. Area directors delegate responsibility for the operation of schools to local school administrators, who administer local education programs in accordance with policies established at national and area levels. Federal schools are supported by annual appropriations made by Congress.

Approximately 90 per cent of the nonprofessional and semiprofessional jobs involved in the operation of the schools are filled by Indians, more than 50 per cent of the professional teaching positions are occupied by qualified Indians, and between 25 and 33 per cent of the key administrative and supervisory jobs in the field of education are held by Indians. Teaching positions in the bureau are secured through competitive civil service examinations. Qualifications include a college degree with specific training in education methods. In 1956 salaries for these positions ranged from an entrance salary of \$3,670 a year to a maximum of \$5,335. Promotions to higher-paying administrative and supervisory jobs are usually made from within the service to employees who have demonstrated their ability and meet the requirements of the specific job. Salaries for administrative and supervisory jobs range from \$5,440 to \$11,395.



Ewing Galloway

Indian girls learn the art of cookery in the cafeteria kitchen at Ganado Mission High School, Ganado, Arizona.

by modern society. This instruction gives meaning to a systematically developed English vocabulary taught in relation to the newer ideas.

In addition, vocational education opportunities are provided for adults who wish to take jobs in industrial centers but lack the basic skills for such employment. Industrial educational opportunities are secured in trade schools. After the completion of a course of study, Indian adults are placed in newer types of jobs where they can utilize their new skills and so enjoy a higher standard of living.

See also INDIAN AFFAIRS—*The Indian Service* (Education).

HILDEGARD THOMPSON,
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Interior.

INDIC LANGUAGES, the name given to the languages of the Indian branch of the Indo-Iranian subfamily of the Indo-European languages. Among the most important are Hindi, Bengali, and Panjabi. See also INDIA—9. *Languages*; INDO-EUROPEAN LANGUAGES; LANGUAGES OF THE WORLD—*Linguistic Families*.

INDICAN, in'dī-kān, a natural crystalline glucoside present in varieties of the indigo plant, and having the formula $C_{16}H_{17}NO_6 \cdot 3H_2O$. It is readily hydrolyzed to indoxyl, C_8H_7ON , and dextrose, $C_6H_{12}O_6$. Plants containing indican have been a source of the blue dye, indigo (q.v.), since the days of the ancients. They were cultivated in semitropical countries until the development of a successful process for the manufacture of indigo in the latter part of the 19th century.

Indoxyl is readily oxidized in alkaline solution to indigo. It is synthesized by a reaction between aniline and monochloroacetic acid, the resulting phenylglycine being converted by soda-amide and caustic soda to the final product.

W. T. READ.

INDICATOR. See CHEMICAL ANALYSIS—*Quantitative Inorganic Analysis*.

INDICTION, a period or cycle of 15 years, believed to have been adopted from Egypt by Rome in the 4th century A.D. as a basis for making property assessments. In the time of Athanasius (293?–373) it came into favor among ecclesiastical writers, and in the Middle Ages it was widely used in Europe. The Constantinian system reckoned indictions from Sept. 1, 312, while the imperial (also known as the Caesarean or Western) system began on Sept. 24, 312. The pontifical (also known as the papal or Roman) system adopted by the popes in the 9th century was based on the beginning date of Jan. 1, 313, and after the 12th century was based on the birth of Christ.

The indiction may be found by subtracting 312 from any year A.D. and dividing the result by 15, or by using the birth of Christ as the beginning date, adding 3 to the year, and dividing the result by 15, the quotient indicating the indiction and the remainder the specific year of that indiction. Thus, by these methods, the year 1957 corresponds to the tenth year of either the 109th or the 130th pontifical indiction, depending on the beginning date used.

See also CHRONOLOGY—*Medieval Chronology*.

INDICTMENT, in law, one of several methods that provide a defendant with a formal, written accusation specifying the crime with which he is charged. An indictment is found by a grand jury from the evidence presented to it by a district attorney or a similar prosecuting official, and is returned by the jury to the court which impaneled it. The term "bill" is applied to an indictment before the grand jury finds it to be a "true bill." It then comes into being as an indictment to serve as the basis of the prosecution of the crime charged therein, against the

person identified there, by name or by such a description as John Doe or Jane Roe.

Indictments are of ancient origin in English law, having evolved from the presentment. Like indictments, presentments are found by a grand jury, but from evidence of its own knowledge or by the jurors on their own initiative rather than at the instigation of prosecuting officials. Like trial by jury, these two forms of accusation constitute one of the bulwarks, of which Anglo-Saxon law is so justly proud, against unlawful accusations and convictions.

The United States Constitution provides in its Bill of Rights that "No person shall be held to answer for a capital, or otherwise infamous crime, unless on a presentment or indictment of a Grand Jury . . ." (5th Amendment), and that "In all criminal prosecutions, the accused shall enjoy the right . . . to be informed of the nature and cause of the accusation . . ." (6th Amendment). These provisions are echoed in the constitutions of the states. Since the Constitution requires only infamous crimes to be presented by indictment or presentment, lesser crimes are frequently presented by an information (q.v.), an essentially similar procedure initiated by the public prosecutor without any grand jury proceedings.

Still other methods of charging the commission of a crime exist. Some states have accusations in forms prescribed by statute. In addition, there are complaints and affidavits preferred by private individuals; these are often restricted to such violations as those against municipal ordinances of the nature of zoning. There are also a few forms no longer in use, such as those initiated by a coroner's inquisition or a jury verdict in a civil case. Although these still exist, they cannot per se serve as accusations, but they may be the basis for the issuance of an information by a state's attorney or of a presentment by a grand jury.

The statutes of the various states exhibit great diversity concerning the crimes which must be prosecuted by indictment and those for which an indictment, a presentment, or an information will lie. In general, the distinction that such lesser crimes as misdemeanors may be based on an information will hold. Many states will allow any crime to be charged by an indictment, however, and custom and efficiency then decide when an information will be used. There is a similarly great variety as to which crimes are designated as infamous, the general rule being that these constitute felonies and crimes punishable by at least one year's imprisonment in a state institution.

To be valid an indictment must give specific information and must be drawn with strict regard for technicalities. Although the law has become less strict, and although immaterial errors may be corrected on trial, major inaccuracies will void an entire proceeding, and a trial and any conviction thereon will be a complete nullity. Furthermore, many states will not allow a waiver of the completeness of the indictment, and its imperfections may be attacked at any time.

Indictments are found solely on the evidence presented, which must constitute a prima facie case, showing by the testimony of witnesses or by the use of documents all the essential elements of the crime. Naturally, the grand jury is presented with only such evidence as is pre-

sumed will be available and admissible during the trial. Only the main points of evidence are presented, however, and without the details or procedure necessary in a trial most indictments can be found a true bill or refused in a few minutes. An indictment is prepared by a district attorney, usually even before the case is presented. If it is found valid, it is signed by the foreman of the grand jury and filed with the court, and a summons or warrant is then issued. The deliberations of a grand jury are held in secret, and its records can be made public only through a court order. The accused does not appear before the grand jury to object, since he is presumed innocent until the indictment is brought to a court trial, where he can prove his innocence or show the impossibility of proving the truth of the charges. In these matters the laws of the states are substantially similar, and the Federal Rules of Criminal Procedure have been deliberately framed to approximate closely the practice general to most states in this regard.

JOHN M. WILLIAMS, JR.

INDIGESTION. See DYSPEPSIA.

INDIGIRKA, ĭn-dĭ-gĭr'kă, river, USSR, located in the RSFSR, in eastern Siberia, in the Yakut Autonomous Soviet Socialist Republic. It rises on the northern slopes of the Verkhoyansk Range and flows in a generally northerly direction for 1,113 miles, crossing the Cherski Range and passing through a frozen tundra to empty into the East Siberian Sea at 71° north latitude and 150° east longitude. There are few villages along its banks, and the river is navigable for more than half its length for 10 to 12 weeks from June to September.

INDIGO, ĭn'dĭ-gō, the common name of a genus of plants and of the blue coloring matter obtained from them. The indigo plants are tall herbs of the pea family, forming the genus *Indigofera*, of which there are several color-yielding species in various warm parts of the world. The one yielding most of the commercial product, and formerly extensively cultivated, is *I. tinctoria*, which is native to India, grows to a height of four to six feet, and has pinnate leaves. A West Indian species, *I. anil*, also yields indigo.



Indigo plant (*Indigofera tinctoria*).

The wild indigo of the United States is any of several species of a closely related genus, *Baptisia*, which flourishes especially in the Southern and Eastern states. Of these the best known is the yellow-flowered *B. tinctoria*, or indigo broom, which has been used as the source of a blue dye and to some extent as a medicine.

Until the opening of the sea route to India in the 15th century the only blue vegetable dye available in Europe was that derived from *Isatis tinctoria* or woad (q.v.), which was limited and costly. Indigo was therefore regarded as one of the most valuable of the new commodities from the Orient, and large funds were soon invested in its cultivation in India, Ceylon, China, and other places, where a profitable industry continued until after the middle of the 19th century. The best quality of indigo was obtained from eastern India, but indigo plantations were started also, with more or less success, in Brazil, Central America, and Mexico. Experimental plantations of early settlers in the United States, from Maryland to Louisiana, failed to survive for long after the American Revolution, mainly because tobacco, cotton, and food crops were more profitable. With the discovery of cheap methods of forming blue dyes from coal tar the cultivation of indigo declined greatly, but it still supplies a small demand from dyers who wish an imperishable blue of certain hues.

The coloring matter of indigo is obtained principally from the leaves, especially at the time of flowering, when the crop is gathered by cutting down the plant and either making immediate use of the green stems or foliage or drying them for later treatment. This coloring matter is a chemical substance called indican (q.v.), the glucoside of indoxyl, which is converted by oxidation into indigo. The leaves and stems are macerated in vats for several hours. Fermentation begins, and the water becomes a clear yellow. The water is then run off into a lower basin, where it is subjected to incessant agitation and gradually turns green, whereupon the indigo begins to form in flakes and to settle. The residuum is thoroughly boiled, filtered through linen, molded into small cakes, and dried.

Before it can be used in dyeing indigo must be brought into solution; and, since indigo itself is insoluble, it must first be transformed into a soluble substance so that it can penetrate the pores of the cloth, where it is subsequently restored again to the form of indigo. To bring the indigo into solution it is ground to a soft paste with water, after which it is thrown into vats with ferrous sulphate, slaked lime, and water. The ferrous sulphate reacts with the lime to form calcium sulphate and ferrous oxide, the latter being immediately oxidized at the expense of part of the oxygen of the indigo, which in its turn is reduced to a substance called indigo white. This dissolves in the presence of excess of lime, and the fabric to be dyed is dipped into the vat after the liquid in it is clear. On removing the fabric, the indigo white which has penetrated its pores is reoxidized by the air to indigo blue, and by repeating this treatment a shade of blue of any desired depth may be obtained. The dyed fabric is finally passed through dilute acid to remove any adhering lime or ferric oxide.

Indigo is now made artificially, production of synthetic indigo having shown a marked increase, along with other types of synthetic dyes, since

World War II. Artificial indigo blue (also known as indigotin) has the chemical formula $C_{16}H_{10}N_2O_2$ and appears to be identical with the natural product in every respect. Although used primarily for dyeing fabrics, indigo is used in the manufacture of certain printing inks and other products. See also DYES AND DYEING.

INDIGO BIRD, a numerous and beautiful North American finch (*Passerina cyanea*), the male of which is dark greenish blue, while the female is grayish brown. They are migratory, but in summer spread over most of the United States, placing their neat nest and unspotted bluish eggs in garden bushes as well as in wild thickets. The male has one of the brightest and most persistent songs of any American bird, and he is easily habituated to captivity.

INDIGO SNAKE. See GOPHER SNAKE.

INDIRECT DAMAGES, claims for damages not directly inflicted by the illegal act complained of, but by other causes themselves due to that act. The great historical case is that of the United States claim for many hundreds of millions of dollars' worth of loss, resulting from Great Britain's bad faith or carelessness in letting the *Alabama*, the Confederate cruiser, escape from her ports to prey on our commerce. It was alleged that aside from the actual loss to our shipping and cargoes, we had been damaged to a far greater extent by the resultant effects, chiefly of three sorts: (1) The prolongation of the Civil War due to the encouragement given to the South and the straitening of the North. (2) The destruction of commercial lines and relations, which took long to recover after the war. (3) The raising of the rates of marine insurance. As these claims exceeded the cost of a war plus the indemnity we should have exacted if victorious, Great Britain refused to consider them; and the commission threw them out altogether as contrary to international law.

INDIRECT ELECTIONS. See ELECTIONS—United States; CONGRESS.

INDIRECT EVIDENCE. See LEGAL TERMS.

INDIRECT TAXES. See DIRECT AND INDIRECT TAXES.

INDIUM, a shiny, ductile metallic element of a silver-white color, discovered by Ferdinand Reich and Theodor Richter through spectroscopic analysis during 1863 in the Freiberg arsenical ores. It is very rare. It is related to cadmium and zinc, and both are associated with it in nature; but it is found in many ores besides, although especially in zinc blende. This metal is obtained by heating the oxide with carbon and by other methods. It is soft, malleable and easily fusible. Its distinguishing property, however, and the characteristic which led to its discovery, is the indigo-blue line which all its compounds—so far as investigated—show in the spectroscope. The spectrum of indium exhibits two characteristic lines: one violet line α , and another blue line β ; and besides these two fainter blue lines are visible if the burner in which the metal is volatilized be fed with hydrogen instead of coal gas. Its specific gravity is 7.1–7.4; its symbol In; and its atomic

weight 114.8. It melts at 155°C . ($=311^{\circ}\text{F}$.) and vaporizes above $1,450^{\circ}\text{C}$. Chemically, indium resembles aluminum and gallium, being chiefly trivalent. See also ATOM—Shell Structure of Atoms; CHEMISTRY; METALS; PERIODIC LAW.

INDIVIDUAL DIFFERENCES, Psychology of. In any science the primary interest is in the typical phenomena and general laws of the field. So it has been in psychology; but the interest of some investigators in subjecting the very differences between people to scientific treatment as phenomena in their own account has been powerfully supported by the modern interest in testing and classifying individual persons. Differential psychology, as it is also called, has come into its own with the demands of application in many practical areas.

Basic to all work in this field is the statistical concept of the normal curve of chance distribution (see Fig. 1, which is plotted from the expansion of the algebraic binomial $(x + y)^n$). It has been observed by other scientists and mathematicians that the laws of chance which govern the fall of a coin or a die obtain also for the occurrence of anatomical traits such as height or chest girth, and, as the psychologist Francis Galton found (see *Bibliography*), for the occurrence of mental traits of a great many kinds. Mathematically, the composite effect of innumerable factors operating independently upon a trait is to produce many occurrences of medium amounts of the trait with fewer and fewer cases of extremely high or extremely low amount, the gradation being represented not by a straight line but by a bell-shaped curve. Methodologically, then, we may expect to find most mental characteristics appearing in a great number of individuals in the proportions suggested by the curve; and clear departures from the curve then suggest the operation of some factor or factors that call for identification. The statistical and graphic methods with elaborations are useful in bringing out many aspects of individual differences: how a given John Doe resembles or differs from his group; how one group of people compares with another in their average score; how one group may have more scattered scores than another; how two mental abilities may or may not vary together.

Turning now from methodology to content and findings, we may limit our survey to two problems. *Male and female* differ, of course, anatomically especially after puberty. So far as intelligence is measurable, no reliable difference at all is found. Great differences in emotionality between man and woman are popularly assumed, but they have not been demonstrated experimentally—though available methods of measuring are far from adequate. In types of interests very great divergence is the rule, but here we deal with something that is certainly a product of social pressures and encouragements and hardly at all a matter of fundamental sex difference.

There is no basis for sorting human beings that is more commonly employed and more provocative of violence than that of *race*. Investigations of racial differences are peculiarly subject to errors that creep in from many sources aside from the unconscious biases of the examiners. For instance, to measure different races of people on American soil, or to apply to Polynesians or Mongolians tests that have been standardized in American schools, is to overlook serious conditions that may blanket out true

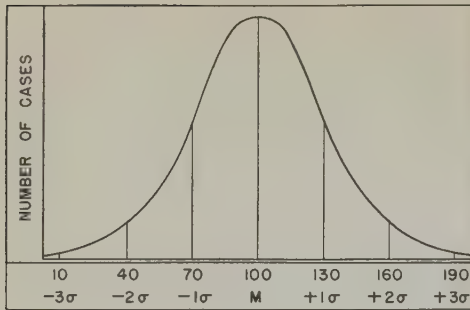


Fig. 1. Frequency curve with standard deviation as a unit of measure on the base line. The mean score of the distribution is 100 points, the standard deviation is 30 points. Note the area of the curve (that is, the number of individual cases) comprehended by 1, 2, and 3 S.D.'s respectively, taken above and below the mean.

differences or may produce specious ones. Franz Boas' statement made in 1894 is as valid today: "The average faculty of the white race is found to the same degree in a large proportion of individuals of all other races." In this area as well as in other dimensions of variation, the sound rule is: so far as native traits are in question, what counts is not the group to which a person happens to belong; it is himself.

Some general conclusions that are much emphasized may be noted. The differences between individuals from the same group often exceed the differences between the means of different groups. Generally abilities go together, so that the individual who stands high in his population in one ability is somewhat more likely than not to stand high in another ability—popular opinion to the contrary notwithstanding. The effects of culture (that is, rearing, education, and social environment generally) are unquestionably very great in producing differences easily confused with native differences.

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INDIVIDUAL LIBERTY, in political theory, freedom from external restraint in the exercise of rights that in a nation organized under a constitutional government are regarded as lying outside the area of government control. Individual liberty is distinguished from *civil liberty*, which is a citizen's *natural liberty* restrained by law only as far as required by essential public interests, and from *political liberty*, the freedom of citizens to participate effectively in government.

Individual liberty includes *personal liberty* (freedom to come and go without hindrance), freedom of opinion and its expression, freedom of conscience and worship, equality before the courts, and security of private property.

INDIVIDUAL PSYCHOLOGY is both a theory of personality and a method of psychotherapy. First formulated and developed by the Austrian physician and psychologist Alfred Adler

(1870–1937), it has come to be of international importance as a system for the understanding of personality and for the prevention and treatment of a wide range of personality ailments.

Individual psychology is one of several "schools" that, in part at least, grew out of Sigmund Freud's psychoanalysis. From 1902 to 1911 Adler was a member of the circle of personal associates of Freud in Vienna, and it is therefore not surprising that individual psychology and psychoanalysis are alike in some respects, for example in their emphasis on unconscious motivation and on childhood experiences and in their belief in the psychogenesis of a wide range of disorders of personality. In 1911, however, Adler left Freud's circle and established his own "school," for by this time important differences between their points of view were becoming increasingly apparent. These differences included Adler's emphasis on the striving for superiority rather than the sex drive, his insistence that neuroses result from disturbances in interhuman relationships rather than from conflicts in the unconscious mind, and his contention that the task of the psychotherapist is to interpret any given symptom in the light of the patient's life goal and his total personality structure rather than to explain the symptom in terms of cause and effect. Adler called his system "individual psychology" because he wanted it to be a personalized approach to personality that studies each individual as a unique whole, with special emphasis on the meaning that interpersonal relations have for him. At the same time he was fully aware that his system, like that of Freud, had many social implications of a far-reaching character.

Principle of Compensation.—As a physician, Adler was naturally interested in the organs of the body, and these, in a sense, were the starting point of his thought. He went on from them to point out that the principle of compensation which plays such a large role in their functioning is also found in the activities of the human psyche. Just as the loss of one kidney results in a compensatory growth of the remaining kidney, with no conscious effort on the part of the individual concerned, so does the psyche tend to compensate for felt organic defects when the organ's natural resources are unable to compensate for its functional weakness. Compensation, a phenomenon of all living things, is as valid a process in mental life as in the realm of the biophysical.

Striving for Superiority.—Individual psychology is dynamic in that it emphasizes the role of motivation in human life, and compensation is the principle that is involved in the production of the great motive called the striving for superiority or the will to power. Every human being has felt inferior as a weak and helpless child in an adult world, and from this "primary" or "relative" feeling of inferiority has come a compensatory striving for superiority.

This feeling and this striving are in no sense abnormal. Because of the operation of any one or more of a number of factors, this "relative" feeling of inferiority can turn into an "absolute" feeling of inferiority that leads to either a neurosis (involving a "Yes, but" attitude toward life's responsibilities) or a psychopathic condition (involving a "No" response). Three predisposing factors commonly found are (1) bodily defects, (2) a pampered childhood, and (3) a neglected childhood. Whether such factors produce un-

desirable personality effects depends upon the individual's reaction to them.

It is not surprising that bodily defects should be regarded as a type of predisposing factor in changing the "primary" or "relative" feeling of inferiority into an "absolute" one. People frequently, though not necessarily, react to a bodily handicap by developing a defeatist attitude. The effects of childhood pampering and childhood neglect are not quite so obvious. Pampering creates an unreal world for the growing child, and sooner or later the individual so reared will experience a great shock when he attempts to make the transition to the real world outside his home. The exalted position that he enjoyed as a child will not be his as an inherent right in the outside world, and he will feel that his status is below what it should be. As for the neglected child, he tends to develop the feeling that he is missing something and that his status is inferior to that of other children who receive the care and attention of loving parents. He is likely to regard the world as an unfriendly place in which he must fight in order to survive, an attitude that predisposes him in the direction of antisocial and criminal behavior.

Whatever the real or imaginary factors to which the individual reacts in such a way as to develop an "absolute" feeling of inferiority, an important result is an intensification of his striving for superiority. In general, the more inferior an individual feels the more he yearns for superiority, and the strength of his drive for superiority is a measure of the depth of his feeling of inferiority.

Individual psychology's teaching that the striving for superiority is a fundamental human motive has frequently been misunderstood to mean that the desire for superiority over other people is a basic motive found in all human beings. The fact is that Adler regarded the desire for superiority over others as either a neurotic or a psychopathic tendency. He was, however, in part responsible for the misunderstanding, for he used Friedrich Nietzsche's phrase "the will to power" as a way of characterizing the striving for superiority, without clearly showing wherein his meaning of the phrase was different from that of Nietzsche. "The will to power" in Nietzsche's sense is an instinct in human nature that is the source of nobility in human life, and nobility is conceived in egoistic and aristocratic terms, with some individuals inherently greater than others. Nietzsche's "will to power" was thus for Adler a symptom of neuroticism or of a psychopathic condition. Adler's "will to power" is a normal and universal human motive for the individual to compensate for and thereby to overcome felt defects, to be superior not to his fellow men but to his own weaknesses.

Life Goal and Style of Life.—In contrast to the mechanistic approach of some schools of psychology, individual psychology is emphatically purposive, holding that no personality can be adequately understood merely in terms of causal determination in the same sense in which the physical sciences explain their phenomena in causal terms. To understand a human being involves more than an explanation in the cause and effect sense; there must also be interpretation of behavior in the light of the individual's personality structure as a whole and especially his specific purposes and his life goal.

The life goal is a generalized purpose or ob-

jective, the thing the individual fundamentally wants. It is set up unconsciously in childhood, usually by the age of four or five. Here the attitudes of the parents, the child's position in the family, and the atmosphere of the home are of great and enduring importance, for the life goal formed at this early age tends to be permanent. The child must be helped to know and to feel that he is an integral part of the human family, that he has something he can share with others, and that in so doing he can experience genuine satisfactions.

Life goals are of two basic types: those that are useful in promoting human welfare and those that are useless or antisocial. If the individual is to live in full accord with his own inner nature, he must have as his goal the making of his best contribution to mankind. There is something in man that favors a life of contribution.

Adler even expressed this way of looking at things in a cosmic setting, holding that there is something in the universe that favors those who give their best to humanity. In contribution is to be found the meaning of life.

A companion concept of the life goal is that of the style of life. The individual's style of life is his characteristic manner of meeting life's problems, the typical "how" of his adjustments. Living is a fine art, and, like any artistic performance, it involves a technique that is unique with each performer. The manner in which a human being relates himself to life is a distinctively personal matter, like the musical style of Bach or Debussy.

The key to the understanding of an individual as a unique whole is to be found in the study of his life goal and style of life. The individual psychologist does not ask himself, "What is the cause of this trait or this symptom in this person?" The question that he tries to answer is rather, "What is the goal of this total personality, and how is he seeking to attain it?" After the latter question has been answered he will understand the meaning of the trait or symptom, its importance and value to the individual, and its relations to other traits or symptoms.

An individual's life goal and style of life are shown in the way he attempts to solve his problems, especially the three great problems of social adjustment, sex adjustment, and vocational adjustment. Of these three the most significant is the problem of social adjustment, for it is the first major problem the child faces as he develops, and the way he solves it sets the pattern that he is likely to follow when he faces the other major problems.

Psychotherapy.—The need for psychotherapy grows out of the fact that many people have a life goal that is useless or antisocial. Large numbers of human beings are trying to get from life more than they are willing to give to life. Socially considered, the objective of psychotherapy is to promote the general welfare by helping these people to see that they have made a serious mistake in their life orientation and to take effective steps to correct it. This is a task of staggering proportions.

Individually considered, the objective of psychotherapy is to help the patient change his useless life goal to one of usefulness. This involves a radical reorientation that only the patient can make, for in the last analysis the therapist can not "cure" the patient, he must "cure" himself.

There are three steps in the psychotherapeutic

process. The first consists in the therapist's coming to an understanding of the patient, especially by discovering his life goal and style of life. An effort is made to see the patient's symptoms in the context of his personality structure as a whole. A variety of techniques make this possible, the principal one being the conversational interview. Therapist and patient sit facing one another in friendly conversation. Other techniques, usually employed as an integral part of the conversational interview, are the interpretation of dreams (both dreams during sleep and daydreams), free association, the study of childhood remembrances (especially the earliest remembrance of which the patient is capable), and the observation and interpretation of the patient's total behavior. In most cases an experienced therapist can complete the work of this first step in the first few interviews.

The second step in psychotherapy consists in helping the patient to understand himself, to know what sort of person he really is. An effort is made to assist the patient to see (1) that he has had a false orientation to life, (2) what that orientation has been, and (3) that he can develop a new and better way of looking at things. The techniques used by the therapist for diagnostic purposes are extended and developed in order to help the patient to gain these insights into his own nature. This second step is much more time-consuming than the first, for the patient's understanding of himself must be increased gradually. Blunt and authoritative pronouncements on the part of the therapist are not likely to be effective in the early stages of therapy, for the patient is not yet capable of dealing adequately with his problems on a conscious level.

In the third and final step in psychotherapy the patient is encouraged to make practical application of the insights he has attained. His efforts to be a useful member of society tend to result in the reduction and eventual disappearance of his disturbing symptoms and in a greater degree of genuine satisfaction and happiness than he has previously known. This stimulates the patient to make further efforts and helps to instill in him an attitude of courageously going about the business of solving his life problems.

These three steps in psychotherapy are not separated from each other in any absolute way—the first shades into the second and the second into the third. During the entire course of treatment the therapist maintains an attitude that is friendly and encouraging, but, in contrast to psychoanalysis, the development of a strong emotional bond between the patient and the therapist as a stage in the therapeutic process is not regarded as either necessary or desirable. The number of interviews per week varies from case to case, but is usually two or three. The duration of treatment varies greatly, averaging about three or four months and seldom extending beyond a year.

Individual Psychology as a Movement.—As an international movement individual psychology gives evidence of increasing vitality. Although its development was hindered in some of its phases by World War II, the years after the war have witnessed a widespread interest in it.

The movement's international organization is The International Society of Adlerian Psychology, with headquarters in Zürich, Switzerland. In the United States the national organization is The American Society of Adlerian Psychology. Local organizations exist in New York, Chicago, and

Los Angeles. National and local societies are also found in London, Paris, Amsterdam, Brussels, Zürich, and Vienna.

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The American Society of Adlerian Psychology publishes *The American Journal of Individual Psychology* semiannually. Articles on individual psychology also appear from time to time in *The American Journal of Psychotherapy*.

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INDIVIDUALISM, in-dī-vid'ū-āl-iz'm, a regard for and emphasis of the individual. In the field of ethics, those doctrines which dwell upon individual welfare and are based upon the dictates of individual feeling. Under these views, it is taken for granted that if each individual seeks his own highest welfare, social welfare will take care of itself. Individualism is opposed to socialism and finds defense in the works of John Stuart Mill and Herbert Spencer. It becomes the duty of the state, under this conception, not to interfere with the individual except when it is necessary to preserve the opportunity for action. The function of the state is regarded as an artificial restraint, while individual initiative is a natural factor in evolution. See also UNITED STATES—44. *Way of Living* (American Heritage): American Individualism.

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INDIVIDUALITY, in-dī-vid'ū-āl'i-tē, a separate and distinct existence. The fact that one thing may be distinguished from all others gives individuality its meaning. Whether the distinction is only relative or is absolute is disputed among philosophers. The problem arises out of the difficulty of thinking of any distinctive character of an individual, except its location in space or time, without using general concepts. With Plato, the universals alone were real. With Aristotle, reality was found in the concrete individual and the universal stood only for an abstraction. The same problem occurs in medieval times, in the discussion of the relation of God, Trinity, and man, and in modern times in the question of the relation of the individual to society.

INDO-ARYAN LANGUAGES. See INDIA—9. *Languages*; LANGUAGES OF THE WORLD.

INDO-EUROPEAN LANGUAGES, the name invented by scholars to indicate a group of languages evidently related, that is, descending from a common ancestor language, of which we possess no direct record. The name Indo-European is inexact in both its components, since not all languages of Europe belong to this family, nor are the Indo-Aryan languages the only Indo-European languages outside Europe. Nevertheless, other terms, such as Aryan, Aryo-European, Indo-Celtic, and Indo-Germanic, though perhaps more correct, have not gained much foothold, at least in English-speaking countries.

The kinship of the Indo-European languages can still be seen quite clearly in some word classes, including numerals, family names, and names for the parts of the body: English *three*, *mother*, *foot* are obviously identical with German *drei*, *mutter*, *fuss*; with Latin *trēs*, *māter*, *pēs* (*pedis*); Greek *τρεῖς*, *μήτηρ* (Doric *μάτηρ*), *πούς* (*ποδός*); and Sanskrit *tráyas mātā* (accusative *mātāram*), *pāt* (accusative *pādam*). Sometimes the identity is not quite apparent to the eye, or rather ear, of the layman, but becomes immediately clear when a few simple rules, deduced from other equations, are considered: thus the correspondence of the initial *f* of English *foot*, German *fuss* with the *p* of Latin *pēs*, Greek *πούς*, Sanskrit *pāt*, is found also in many other words, such as English *father*, German *vater* (pronounced *fater*), Latin *pater*, Greek *πατήρ*, Sanskrit *pitā* (accusative *pitāram*); and English *fish*, German *fisch*, Latin *piscis*. On the other hand, Celtic loses initial *p* (English *f*, German *f*), and *fish* is therefore *iasc* (*a* is an epenthetic vowel), and *father*, *athir*, in Old Irish.

From the study of the original Indo-European material, discovered with the help of such rules as Grimm's and Verner's laws (qq.v.), the original vocabulary and therefore the original culture and home of Indo-European people before the separation can be deduced. The Indo-Europeans had no words for tropical or even Mediterranean products, plants, and animals, such as the laurel tree, the grapevine, the fig tree, the ape, the camel, the tiger, and the donkey; but they had words for northern animals and plants, such as the bear, the wolf, the cow, the goat, the pig, the goose, the apple tree, the oak, the beech, the birch, and the pine. Since they also had a name for snow, they obviously lived in a northern, cold climate; and this fact, as well as the names of some animals (especially the salmon) and plants, points toward the eastern shores of the Baltic Sea (Latvia and Lithuania).

The culture of the Indo-Europeans was very primitive, being in the Aëneolithic period, with little metal. They had a very modest form of agriculture that included the plow and some domesticated animals (the pig, dog, goose, cow, goat, sheep, and, later, the horse), but they lived mostly by hunting and fishing. Moreover, they had little acquaintance with navigation, very little industry, and almost no trade. They had of course no writing and counted no further than 100. All these conclusions are confirmed by the historical fact that in the whole Mediterranean and subtropical belt from Gibraltar to Calcutta, where ancient refined civilizations flourished, we see the Indo-Europeans

arriving as northern barbarians, destroying or assimilating previous native cultures (Minoan, Khattite, Babylonian, and so on), all belonging, it seems, to non-Indo-European peoples.

The Indo-European language was highly inflectional (English *boy: boys*); had vowel gradation (*gift, give, gave; song, sing, sang, sung*); distinguished sharply between the different parts of speech (especially the noun and the verb); had three genders (masculine, feminine, and neuter or inanimate: English *he, she, it*); had a constant agreement between adjective, noun, and pronoun; and had a special predilection for anomaly and "suppletivism" (English *I am: you are: I was: I have been; I go: I went*). All of these characteristics, however, tend to disappear more or less rapidly in all Indo-European languages, and English is a very good example, having departed further from the inflectional type than any other Indo-European language, with the possible exception of modern Persian. English has sharply reduced the endings (*I love, you love, we love, they love*), the vowel gradation (*love, I love, I loved, loved*), and the genders (which now find almost no formal expression except in some pronouns); the agreement between adjective and noun has disappeared entirely, and anomaly and suppletivism almost completely; and the distinction between the different parts of speech is weakening constantly, favored by the loss of the endings. *Dance, loan, bomb, cut, want, will, and love* are both nouns and verbs; in *I do not feel good* and *hit him hard*, the difference between adjective and adverb is lost; in *I distinguish good and evil*, the distinction between noun and adjective is disappearing; and *like* in colloquial English is a noun, a verb, an adjective, an adverb, and a conjunction. Such sentences as *I danced once with my wife* and *I shall not loan the book to Peter* are examples of an agglutinative, not an inflectional, language (the words *the, to, with, not, and shall* cannot be used independently); *I see you are well, I think we need money, we love wine, and I give Peter what I want* are sentences of an isolating language, for every word can be used in isolation (*we, love, what, wine, think, I, money*). The substitution in colloquial American, of *good* for *well* (in the phrase *I feel good*), of *me* for *I* (*it is me*), of *loan* for *lend*, and of *who* for *whom* shows the trend of the language away from inflection. Sentences like *He saw the geese and the oxen running away* and *He went out of his father's house* show remains of the inflectional type.

See also LANGUAGES OF THE WORLD.

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INDOCHINA, ĩn'dô-chĩ'nà, (1) the geographical name of the peninsula projecting from the Asian mainland between India and China; and (2) the political name of those parts of the peninsula that were colonial possessions of France and were therefore also called French Indochina. In the geographical sense, Indochina comprises, from west to east, Burma, Malaya, Singapore, Thailand, Cambodia, Laos, and Vietnam, which have a combined area of 795,148 square miles and a population (est. 1959) of 84,784,000. In the political sense, Indochina or French Indochina (Indochine Française) consisted of the three states of Vietnam, Cambodia, and Laos.

The name Indochina for this peninsula was introduced at the beginning of the 19th century

by the Danish-born French geographer Conrad Malte-Brun. Gradually it replaced the older names of Farther (Further) India in English and Inde Extérieure in French; in German, Indochina has become synonymous with Hinterindien. Charles Robequain, in his *Economic Development of French Indo-China* (p. 13, New York 1944), calls Indochina "a well-chosen name," pointing out that French Indochina "is only a part of the geographic bloc called Indochina," but the French habit of calling Indochine Française simply Indochine caused the term "Indochina" to become international usage in place of "French Indo-China." Since French Indochina no longer exists, the name Indochina should again designate only the entire peninsula, for which geographical, ethnological, and historical reasons make it both accurate and useful.

The Land.—The Indochinese Peninsula lies next to both India and China. This is true although Indochina is really a southern extension of the Chinese land masses. Three mountain ranges that originate in southwestern China and eastern Tibet run through the peninsula from north to south, connecting it with China, but not more closely than the ocean in the west connects it with India. One of these ranges separates Assam, India, from Burma, and another runs along the border of Burma and Thailand and on through the narrow southern arm of the peninsula that becomes Malaya. The third range is the Annamese Cordillera, which extends in a slightly southeasterly direction from Yunnan to southern Vietnam; several of its eastern arms run directly into the South China Sea.

The ranges determine the general north-south direction of the major rivers, which have formed and continue to enlarge Indochina's fertile deltas. From west to east these rivers are the Irrawaddy and the Salween in Burma; the Chao Phraya (Mae Nam or Menam) in Thailand; the Mekong, separating Thailand and Laos before it crosses Cambodia and South Vietnam; and the Red River, which flows from northwest to southeast through North Vietnam, rising in Yunnan and emptying into the Gulf of Tonkin (Tongking). The silt of these rivers and their flooding of the valleys and deltas contribute to Indochina's relative wealth, which consists in substantial surpluses of rice for export in Burma, Thailand; and Vietnam.

The productivity of the land is related to the climate, which is largely tropical and monsoonal with dry and wet seasons. While temperatures vary little in the south and as far north as the 20th parallel, their range is wide in the higher altitudes of the north. In the Mekong Delta and in Malaya summer and winter temperatures are only a few degrees apart, but in parts of North Vietnam and northern Burma, where the summer may be as hot as in the south, winter frosts are not infrequent. Over most of Indochina winter is the dry season, and summer the rainy season, but because of differences of topography and latitude the beginning and length of the two seasons and the amount of local rainfall vary in different regions.

The People.—Since prehistoric times the river valleys of Indochina have been migration routes for successive waves of immigrants from southern China and Tibet, many of whom were forced by later arrivals to move from the peninsula to the islands of Southeast Asia and the Pacific. The first inhabitants of Indochina are

thought to have been Negritos; remnants of these, akin to the Australian aborigines and the Papuans of Melanesia, can still be found in remote corners of the peninsula. The Negritos were followed by the Malayo-Indonesians, who still form the basic population stock in several Indochinese countries. A third wave of immigrants, whose movement began only in historic times, consisted of peoples of predominantly Mongolian race—those of Burma, who are probably of Tibetan origin; those of Thailand and Laos, who came from southwestern China; and the Vietnamese (or one of the branches that went into their racial formation), who are thought to have come from the lower Yangtze Valley. Because of these migrations, the population is both very diverse and very mixed.

In addition to the six more or less distinct leading nations (the Burmese, the Malaysians, the people of Thailand, their cousins in Laos, the Cambodians, and the Vietnamese), there exist in all parts of the peninsula countless numbers of so-called ethnic minorities. Most of these groups are not only different from the main body of the population, but also from each other. Often they consist only of small tribes. They speak a bewildering variety of languages and still lead on the whole very primitive lives.

Another strong element in the population picture consists of the Chinese, who are the largest minority group in several countries (Vietnam, Cambodia, Thailand, Malaya). Their occupational preference for trade makes them city dwellers, in contrast to the indigenous tribal minorities, who inhabit the remoter and more mountainous regions of the peninsula.

In general, the population of Indochina is relatively sparse. In Vietnam the density is approximately 221 persons per square mile; in Thailand, 110; and in Burma, 78. It is considerably lower in Laos, where 1,690,000 persons (est. 1958) live in a territory slightly larger than Great Britain.

HISTORY

The first known Indochinese states were Funan and Champa. They seem to have arisen at approximately the same time, Funan in the 1st century A.D. and Champa in the 2d century, and they owed their origin and high degree of civilization to Indian cultural penetration. By the 3d century, Funan had attained a commanding position over the south, center, and west of the peninsula, and through its seapower over other regions of Southeast Asia as well. Champa occupied the east coast of Indochina as far as the borders of China, which then extended south beyond the Red River valley, the home of the Vietnamese since the 3d century B.C. The populations of Funan and Champa were Malayo-Indonesian, and the culture of both states was entirely Hinduized. Funan, by far the larger of the two, barely survived the 6th century A.D. It was defeated and finally annexed by Chenla, a former vassal state situated in the northern part of the empire. Chenla's victory over Funan was the starting point for the rise of a new and even more powerful Indochinese state, the Khmer or Cambodian Empire. The power of Cambodia extended from Champa in the east over the entire center of Indochina far down to the southwest and up to the northwest, where the Malaysians and the Tibeto-Burmese, respectively, had begun to form several minor states. Cambodia reached the height of its power and of its cultural achieve-

ments in the 12th century, which saw the completion of Angkor (q.v.).

Meanwhile, in the northeast, Vietnam had become independent of China in 939. The Vietnamese, who, in contrast to the Hinduized Cambodians and Chams, were pupils of Chinese civilization, soon began to push southward. They expanded their country, first at the expense of Champa and later at that of Cambodia, along the east coast until they reached the Gulf of Siam. By the end of the 15th century, Vietnam had eliminated Champa and was threatening southern and eastern Cambodia, whose power and territory were also being reduced in the west by a newly arising Indochinese people. These were the Thai, who for centuries had been steadily moving from southwestern China into Indochina and, in the 13th century, had begun to form one of the strongest and most enduring of all Indochinese states, Siam (now Thailand). Siam grew quickly at the expense of Cambodia. It also extended its power far into Malaya and Burma and was prevented from ruling the entire peninsula only by the gradual rise of a strong Burma in the west, a powerful Vietnam in the east, and the refusal of certain Thai people in the north to accept Siamese rule. These northern Thai later formed the Kingdom of Laos. Between Thailand and Vietnam, Cambodia was slowly reduced to its present size, Vietnam acquiring the fertile regions of the lower Mekong Valley that later became known as Cochinchina. With the survival of several states in Malaya despite Thai pressure, the modern political map of Indochina had more or less taken shape by the mid-18th century.

From the beginning of the 16th century, however, Indochina had become more and more subject to European influences and interference. The Portuguese conquered and held for a while parts of the west coast, but they failed, as did the Dutch, English, and French in the 17th century, to gain a foothold in the east. Control of Indochina by the Western powers became a historical fact only in the 19th century. After three wars (1824-1826, 1852-1853, and 1885-1886), the British added possession of Burma to the previously conquered states of Malaya and the colony of Singapore. The French attacked and occupied eastern Indochina in several stages between 1858 and 1893. After World War II, in 1948, Burma regained its independence. Malaya became an independent member of the Commonwealth of Nations in 1957, and Singapore was made internally self-governing in 1959.

French Indochina.—After two centuries of peaceful interference in Vietnamese affairs—through missionary activities, attempts at trade, and assistance—the French began the conquest of eastern Indochina with an attack on Tourane, Vietnam, in August 1858. The attack failed, as did an attempt to conquer southern Vietnam in February 1859. Having barely been able to hold Saigon during the year 1860, the French undertook a new invasion of the south in 1861. Vice Admiral Louis Adolphe Bonard succeeded in joining the beleaguered French garrison at Saigon, in occupying three provinces adjacent to the city, and in inducing the Vietnamese emperor and court to sign a treaty through which Saigon and the three provinces were ceded to France (June 1862). After strengthening their Saigon base, the French imposed a protectorate on Cambodia in 1863 and annexed the remaining southern provinces of Vietnam in 1867. The occupied parts

of Vietnam became the colony of Cochinchina. An attempt to conquer northern Vietnam (Tonkin or Tongking) in 1873 failed, but a new, more powerful attack was launched in 1882. In 1883-1884, Vietnam was forced to sign treaties recognizing French protectorates over the north and center (the latter referred to as Annam).

These protectorates over Cambodia, Tonkin, and Annam soon proved to be legal formalities to disguise direct French rule. In 1887 they were combined with the colony of Cochinchina in the Indochinese Union and placed under a single governor general. The Kingdom of Laos was added to the French possessions in Indochina in 1893, and the territory of Kwangchow (Chankiang) was leased from China for 99 years in 1898, but the Indochinese Union became a political and administrative reality only under Governor General Paul Doumer. During his term of office (1897-1902), French Indochina received a centralized and modern administration as well as the means of systematic economic development and of exploitation of its resources. These resources lay chiefly in Vietnam and Cambodia, and consisted in a potential for a large rice surplus, in easily extractable deposits of coal and rare metals, and in the so-called red earth of the south, where the French soon developed profitable rubber plantations. Although French rule met with increasing nationalist opposition in the 20th century, French Indochina, with an area of 283,988 square miles, remained France's richest colony until the outbreak of World War II.

In 1940, after negotiations with the Vichy government, the Japanese were allowed to move into French Indochina, which they quickly turned into one of the main bases for their conquests in Southeast Asia. Shortly before their defeat they disarmed the French and allowed the Vietnamese emperor, Bao Dai, to declare Vietnam independent, but after the war the French returned to South Vietnam and Cambodia with British aid. French rule was gradually re-established, though incompletely, over the rest of French Indochina. In August 1945, nationalist forces had succeeded in forming a government in North Vietnam (Hanoi), which proclaimed Vietnam an independent republic, and in launching a vast resistance movement against the reimposition of French control. Although the Vietnamese national resistance movement was under strong Communist influence, because of military weakness the French recognized the government at Hanoi in March 1946. The breakdown of subsequent Franco-Vietnamese negotiations on the future status of Vietnam within the French Union led to war in Indochina, which lasted from December 1946 to June 1954. The Indochinese Union, which in 1946 became the Associated States of Indochina, consisted after 1949 of the three supposedly independent states of Vietnam, Cambodia, and Laos, but their independence was more nominal than real, and neither French military efforts, strongly supported by the United States, nor piecemeal political concessions were able to overcome Vietnamese national resistance. After the defeat of Dien Bien Phu in May 1954, caused largely by Chinese supplies for the Communist-led Vietnamese forces, France was ready to give up. This led to the Geneva agreements of July 1954, which put an end both to the war and to the existence of a French Indochina. Its population was then estimated at 31,460,000.

See also BURMA, UNION OF; CAMBODIA;

LAOS; MALAYA, FEDERATION OF; SINGAPORE; THAILAND; VIETNAM.

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INDONESIA, in-dō-nē'zhā, **Republic of**, a unitary state in Southeast Asia occupying all of the Malay Archipelago west of New Guinea and south of the Philippines, except the eastern half of Timor, a 950-square-mile enclave on the northwest coast of Timor, and the northwestern section of Borneo. Netherlands New Guinea, the western half of that island, is also claimed by Indonesia. Before independence was proclaimed in 1945, the country constituted the Netherlands East Indies.



Coat of arms of Indonesia.

The more than 3,000 islands composing Indonesia stretch 1,100 miles across the equator (5°30' north to 12° south latitude) and 2,800 miles between Asia and Australia (95° to 135° east longitude), and separate the Indian Ocean from the Pacific Ocean. The country has an area of 575,893 square miles, in six main physical divisions: Sumatra; Java (including Madura); Kalimantan (Borneo); Sulawesi (Celebes); Nusa Tenggara (the Lesser Sunda Islands, chiefly Bali, Lombok, Sumbawa, Sumba, Flores, and Timor); and Maluku (the Moluccas). With a population of 92,700,000 according to the 1960 estimate of the Indonesian National Planning Council, Indonesia is the sixth most populous country in the world. The populations of the larger islands were estimated as follows: Java, 58 million; Sumatra, 15 million; Sulawesi, 7 million; and Kalimantan, 4 million. The capital is Djakarta, known as Batavia while it was the capital of the Netherlands East Indies. The republic's motto is *Bhinneka Tunggal Ika* (Unity in Diversity). Its flag is red over white, and its national anthem is *Indonesia Raya*.

The present article is divided into the following main sections:

1. Political Divisions, Chief Cities, and Populations
2. The People
3. The Land
4. The Economy
5. Cultural Activities
6. Government and Politics
7. History
8. Bibliography

See also separate articles on individual islands and island groups, such as Borneo; Celebes; Java; Moluccas; Sumatra.

1. POLITICAL DIVISIONS, CHIEF CITIES, AND POPULATIONS

Politically, Indonesia is divided into 22 provinces, including two special districts, as follows:

PROVINCE	CAPITAL CITY
<i>Sumatra</i>	
Atjeh	Kutaradja
North Sumatra	Medan
West Sumatra	Padang
Riau	Tandjungpinang
Djambi	Djambi
South Sumatra	Palembang
<i>Java-Madura</i>	
West Java	Bandung
Central Java	Semarang
East Java	Surabaya
<i>Kalimantan</i>	
West Kalimantan	Pontianak
South Kalimantan	Bandjarmasin
East Kalimantan	Samarinda
Central Kalimantan	Palangkaradja
<i>Sulawesi</i>	
North Sulawesi	Manado
South Sulawesi	Makassar
<i>Nusa Tenggara</i>	
Bali	Singaradja
East Nusa Tenggara	Kupang
West Nusa Tenggara	Mataram
<i>Maluku</i>	
Maluku	Ambon
Irian Barat ¹	Soasui, Tidore Island

Special Districts

Metropolitan District of Djakarta-Raya (Greater Djakarta)

Special Autonomous District of Djokjakarta

¹ Includes claimed area of Western New Guinea (West Irian).

Some of the large cities of Indonesia, with their populations (1960 estimate unless otherwise noted), are: Djakarta (2,081,200), Surabaya (1,135,300), Bandung (951,900), Semarang (444,800), and Djokjakarta (Jogkjakarta, 1957 est., 289,400), all in Java; Medan (342,200) in Sumatra; and Makassar (357,400) in Sulawesi. Other important cities are: Surakarta (also called Solo), Malang, Tjirebon, and Bogor (formerly Buitenzorg) in Java; Palembang and Padang in Sumatra; Bandjarmasin and Pontianak in Kalimantan; and Manado in Sulawesi. In eastern Indonesia, Denpasar and Singaradja are the largest towns in Bali; Mataram in Lombok; Waingapu in Sumba; and Kupang in Timor. Of the commercial centers in Maluku, Ambon (Amboina) is the largest; Ternate off the western coast of Halmahera is second; while others, some historically important, are Tidore on Tidore Island, Bandanaira on Banda, Saumlaki on Tanimbar, Tual in the Kai Islands, and Dobo in the Aru Islands.

2. THE PEOPLE

Origins.—Although predominantly of Malay stock, Indonesians are of varied physical types, and their customs, clothing, ways of living, and folklore are even more diverse. The earliest Indonesians were of six different stocks and admixtures: Australoid, Melanesian, Negrito, and Veddoid, Papuan, and the so-called Alfur hybrid (Papuan and proto-Malay stocks intermixed). Today, most of the people representative of these archaic stocks inhabit eastern Indonesia or isolated interior areas of the larger western islands. Subsequent migrations came into the archipelago from Asia. The first Malays were the proto-

Malays (q.v.)—short, stocky, dark skinned, wavy haired, with Caucasoid features indicating their distant kinship with Europeans. The Mongol movement into southern Asia wrought changes resulting in the later, increasingly Mongoloid, deutero-Malay group, many of whom have the epicanthic fold ("slant-eyed" appearance) and more prominent cheekbones. Proto-Malays now occupy the interiors of the larger western islands of Indonesia and some of Nusa Tenggara, while deutero-Malays are coastal settlers. Further admixtures occurred as groups of Indians, Arabs, Chinese, and, most recently, Europeans entered the archipelago.

Composition.—The principal ethnic groups in each major region are: (1) in Sumatra: Atjehnese and Coastal Malay, Redjang-Lampung, Batak, Gayo-Alas, Menangkabau, and Kubu; (2) in Java-Madura: Sundanese, Javanese, and Madurese; (3) in Kalimantan: Coastal Malays, Javanese, Bugis or Buginese and others in coastal sections, with interior Dyaks or Dayaks divided into six tribal complexes (Ngadju, Bahau, Klemantan, Iban or Sea Dyak, Land Dyak, and Punan); (4) in Sulawesi: Macassar-Bugis (the largest group, southwest), Minahassa-Gorontalo (of whom the Manadonese are the best known; second largest group, northern), and the Toradja, Sadang, Mori-Laki, and Loinang (smaller groups in the center, southeast, and east); (5) in Nusa Tenggara: the Balinese and other proto-Malays on Lombok, Sumbawa, Sumba, and western Flores; (6) the ethnically diverse peoples of eastern Flores, Timor, and the Alor-Solor Islands; and (7) in Maluku: varied groups, including the Ambonese, with some European, Arabic, and Chinese infusions. The contemporary average Indonesian is short (about 5 feet 3 inches) and slender and has light-to-medium brown skin, straight or wavy black hair, a fairly flat face, a wide nose, and very little body hair. Estimates vary widely, but there are probably more than 100,000 Eurasians in the islands, while the principal alien minorities are Chinese (2 to 3 million), Arab (70,000), Indian-Pakistani (30,000), and several thousand Europeans and Americans, now including very few Dutch citizens.

Language.—The official language is Bahasa Indonesia, or Indonesian, developed from the widely used Coastal Malay, one of more than 30 native languages and 250 dialects belonging to the Malay-Polynesian linguistic stock. The only other important stock, Papuan, is spoken by tribes in easternmost Indonesia. The Indonesian language has absorbed contributions from Indian, Arabic, Dutch, English, and other sources, most recently in order to expand its cultural and technical usage.

Religion.—An estimated 90 per cent of the Indonesian people are Muslims, though Islamic practice has been influenced by pre-existing animism, Hinduism, and adat (customary law). More than 1 million people in Bali and Lombok have retained the once widespread Hindu-Buddhist religion and compose about 1.5 per cent of the population. Christianity, first introduced by the Portuguese in the 16th century, has been spread by many Protestant and Roman Catholic missionaries. The nearly 5 million (about 6 per cent) Indonesians who are Christians are most numerous in outer-island areas (Timor and Maluku to the east), in Minahassa in northern Sulawesi, and in northern Sumatra, center of the largest concentration of Christians, the Bataks.

Way of Living.—Regional characteristics of the Indonesian people vary widely because of cultural, linguistic, and other differences. An easy-going nature, a quickness to smile or laugh, a love of children, and an intense desire to assure the success of independence characterize most Indonesians. Home and family life is epitomized in innumerable small villages. Most cultural groups are patrilineal; the Menangkabau of Sumatra are Islamic and matrilineal. In urban areas, people of similar cultural backgrounds (Javanese, Batak, Chinese, and so on) tend to cluster together. Rice is the staple food, usually with fish or vegetables for protein and sharp pepper for flavor. In some regions maize, sweet potatoes, sago, bananas, or other starches replace rice. Chickens, ducks, or goats supply meat, though non-Muslims eat pork, and beef is used particularly for feasts. Tea and coffee, and sometimes coconut, chocolate, and goat or cow milk are the major beverages. Cigarette smoking and *sirih* or betel-nut chewing are widespread.

Characteristic clothing for women is the *kain* (sarong) and *kabaya* (fitted blouse with long sleeves); for men, *kain* in rural areas or on religious days, fezlike *pitji*, and, in cities, Western trousers and shirts. Regional variations are numerous, in urban areas, Western clothing is increasingly common. Married women usually wear their hair in a bun; unmarried girls braid their hair in pigtails or wear it long, but Western styles are also seen.

Soccer football, badminton, and volleyball are the most popular sports, but interest in swimming, tennis, and basketball is increasing. Student, religious, labor, and other organizations frequently participate in parades honoring people or events; and for many decades, until it was disbanded in 1961, the boy scout movement was an outstanding part of Indonesian life.

Health.—Health problems are still serious in the nation. Malaria and tuberculosis each cause about 10 per cent of the deaths, with yaws the third most serious illness. Trachoma, dysentery, leprosy, and typhoid are also widespread. Most disease in Indonesia is attributable to overcrowded housing, undernourishment, general poverty, debilitation from other diseases, and shortages of public health facilities and doctors. Despite a 2 per cent annual population increase, Indonesia's infant mortality rate may be as high as 150 per 1,000 live births.

3. THE LAND

Physical Character.—Geologically, the Indonesian archipelago has three sections: (1) the Sunda Platform, a southeastern extension of ancient Eurasian structures, formerly above sea level, now underlying Sumatra, Java, Kalimantan, and the shallow waters between them and the Asiatic continent; (2) the Sahul Shelf, the northernmost section of the ancient Australian Shield, also above sea level in recent geologic time, supporting the eastern islands and New Guinea; and (3) an intermediate area, including the western islands of Nusa Tenggara, Sulawesi, and some of Maluku, all rising out of deep waters that were once part of a broad strait separating the enlarged Asiatic and Australian continents. Wallace's line (see WALLACE, ALFRED RUSSEL) and Weber's line, running through the intermediate area, mark the transition between Asiatic and Australian flora and fauna.

Indonesia's topography is one of marked con-

trasts. The most extensive mountain system extends from northern Sumatra southward near its west coast and curves eastward across southern Java to Nusa Tenggara. The section in Sumatra known as the Barisan Mountains rises to 12,467 feet at Mount Kerintji, south of Padang. Lesser ranges sweep northward across Kalimantan, Sulawesi, and Maluku. Indonesia has more than 100 active or recently active volcanoes, most of them part of the major mountain system. Lake Toba, Indonesia's largest freshwater lake, occupies a huge extinct volcanic *caldera* in northern Sumatra. The most famous volcano is the tiny island of Krakatau (q.v.), in the Sunda Strait between Sumatra and Java, which erupted explosively in 1883. Broad plains lie east of the Barisan Mountains in Sumatra, north of the volcanic mountains in Java, and in several parts of Kalimantan. Elsewhere, most level land is found on coastal fringes of mountainous islands. Waters are shallow in the Strait of Malacca between Sumatra and Malaya, in the Karimata Strait separating Kalimantan and Sumatra, in the Java Sea on the Sunda Platform, and on the Sahul Shelf in eastern Indonesia; but deep waters are characteristic of the Indian Ocean and the narrow seas, including Makassar Strait between Kalimantan and Sulawesi, of the central archipelago. The longest rivers are the east-flowing streams of Sumatra with headwaters near the western coast and those of Kalimantan rising in its north-central mountains.

Climate.—Located astride the equator, Indonesia has a tropical marine climate, having at sea level uniform, high temperatures, high humidity, and moderate to heavy rainfall. Seasonality results from changes in wind patterns and directions. The average monthly temperature ranges between 77° and 81° F.; the average daily temperature fluctuates between 70° and 90° F.; and the absolute range is 61° to 97° F. Most of western and northern Indonesia is characterized by a tropical rain forest climate with average annual rainfall of more than 80 inches. Eastward from central Java a savanna or tropical wet and dry climate prevails, with decreased annual rainfall and increased variability as to total rainfall and length of dry season. Throughout Indonesia, amount of rainfall, temperature, and humidity vary with elevation, winds, and distance from the coast. The Asiatic or west monsoon is strongest close to the continent; the Australian monsoon influences eastern Indonesia. The decrease of temperature at increased elevations is shown in Java, where at Djakarta (coastal) the average annual temperature is 78° F.; at Bogor (800 feet), 75°; at Bandung (2,300 feet), 71°; and at Tosari (5,800 feet), 61°. Highlands near populous lowlands provide temperature relief, with cooling air drainage, and have accessible places to visit; they are densely populated in parts of Java and Sumatra.

Natural Resources.—Most of the soils of Indonesia are thin latosolic soils developed under rain-forest conditions and subject to rapid leaching and erosion when cleared for cultivation. The most valuable are the fertile soils derived from basic volcanic rocks, some limestone soils, and stream-deposited alluvium, notably in Java (where most of the population is concentrated), in the plantation lands of northeastern Sumatra, and in northern Sulawesi (Minahassa District).

Two thirds of Indonesia is covered by rain forest (240 million acres), which predominates

throughout the western and northern islands, grading into savanna (parklike clumps of trees and grassland) toward the southeast. The estimated forested area in Java is 23 per cent; Sumatra, 60 per cent; Kalimantan, 77 per cent; and eastern Indonesia, 50 per cent. As many as 3,000 families of plants grow in the archipelago, with considerable local variety. The typical coastal forest consists of mangrove trees grading into a narrow belt of nibong or nipa palms, with a broad belt of coastal swamp and upland forest farther inland, including many commercially valuable Dipterocarpaceae species. With increasing elevation, subtropical to temperate zone mountain forests, including stands of pine and conifers, predominate, while mountain mossy forests occupy the highest lands. Bamboo and rattan, in a wide variety of types, are major plants throughout Indonesian forests.

Animal life, also varied, is characterized by both Asiatic and Australian influences. Elephants, tigers, wild boar, leopards, rhinoceroses, and many varieties of monkeys and apes, including the orangutan, are found in the western islands. Marsupials, similar to those of Australia, are in great variety in eastern Indonesia. Smaller animals include tapirs, deer, wild pigs, squirrels, lemurs, bats, and flying foxes. Crocodiles are plentiful in rivers, while snakes, such as the python, and lizards—some as small as the household insect-catching *tjetjak* and others up to 10 feet long—are prevalent. The abundant insect life includes most varieties of mosquitoes; white, black, and red ants; spiders; scorpions; and the praying mantis (and related walking leaf and walking stick). Birds include the pheasant, pigeon, peacock, and bird of paradise, parrot, kingfisher, duck, and cockatoo. Both freshwater and sea fish, such as the tasty *kakap*, mollusks, crustaceans (*udang* or shrimp), sharks, and octopuses, are plentiful.

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4. THE ECONOMY

The history of the Indonesian economy in the first decade of political independence should be viewed against a background of low levels of material welfare and economic resources, decades of colonial economic domination, and eight years of military occupation and war. Annual per capita income was about \$100 or below, and there was no clear evidence of a secular rise over the decade. About 80 per cent of the population earned a livelihood in the agrarian sectors, which use relatively little capital. Approximately 48 million rural people live on the 21 million arable acres of fertile soil on the islands of Java and Madura—averaging less than one half acre per person. Conditions on the outer islands are more favorable, but the costs have hitherto proved too great for extensive transmigration from Java, which remains the most densely populated large area in the world.

The small manufacturing sector, which unlike the agricultural sector uses capital intensively, accounted for only about 8 per cent of gross domestic product. The small size of this sector—a legacy of the colonial economy discussed above—is perhaps the most important indication of low levels of capital resources and entrepreneurial and technical skills. Moreover, even as late as 1940 only 37 Indonesians graduated in that

INDONESIA

INDONESIA
Total Population 95,889,000

CITIES and TOWNS

Amboina, 55,100	H 5
Balikpapan, *69,461	E 6
Bali, 176,800	E 6
Bandung, 931,200	K 2
Banjari, 53,576	K 2
Batavia, *26,706	K 2
Bauau, 21,058	G 7
Bengkulu, 12,000	C 6
Bintulu, 468,500	C 6
Bitar, *43,661	K 2
Bojor, *17,886	H 2
Boninah, *48,283	F 6
Bukittinggi, 52,824	F 6
Djalolo, *10,170	H 5
Djakarta (cap.), 2,922,000	H 1
Djambi, 86,419	H 1
Djatinegara	C 6
Dokjaka, 289,400	H 2
Dongala	F 6
Ende	F 5
Endonito	G 5
Indragiri, *56,117	G 5
Kediri, *46,111	K 2
Kendari, *21,065	K 2
Kerapas	F 7
Kudus, 62,130	F 7
Kupang, *31,171	F 7
Kutaraja, 25,082	B 4
Lahat, *25,781	C 6
Langsa, *47,044	B 6
Lhokseumawe	B 4
Madun, 90,778	J 2
Magelang, 81,799	J 2
Makassar, 357,400	F 6
Malang, 300,651	K 2
Manado, 68,000	F 6
Maratapura, *53,216	E 6
Mataram	F 7
Medan, 353,700	F 6
Nangapinoh, *24,836	B 6
Padang, 200,000	B 6
Padang Dempuan, *71,704	B 6
Palembang, 337,300	C 6
Palopo	C 6
Pamekasan, *42,650	F 6
Latest official figures. *District population.	L 2

Parepare, *58,514	F 6
Pasuruan, 56,293	K 2
Pemalang, 93,904	J 2
Pemalangantar, 67,000	B 5
Pontianak, 130,100	D 6
Poso	G 6
Probolinggo, 64,716	K 2
Raba	F 7
Renang, 38,936	K 2
Rengat, *22,962	K 2
Samarinda, 49,269	F 6
Samarinda, 514	F 6
Sawahlunto, 12,000	C 6
Semarang, 468,500	C 6
Serang, *43,661	K 2
Siobaja, 33,472	B 5
Sigi, 4,050	B 4
Simeulue, 25,931	A 5
Singaraja	F 7
Sintang, *25,067	E 5
Sukabumi, 71,560	E 5
Sukadana, 6,889	E 6
Surabaya, *1,135,300	E 6
Surakarta, 393,547	K 2
Tandjungselor	J 2
Tarakon, 24,807	F 5
Tegal, 86,762	F 5
Teukubetung	H 2
Ternate, 23,500	C 6
Tijah, 112,964	D 7
Tijah, 78,619	H 7
Tirene, 135,984	H 2
Wainapu	H 2
Weda	G 7

PHYSICAL FEATURES

Alor (isl.)	G 7
Amboyna (cap.)	G 7
Anambas (isls.)	E 4
Aralura (sea)	J 5
Aru (isls.)	J 7
Aru (cap.)	G 5
Babar (isls.)	H 7
Bali (isl.)	E 7
Banda (isls.)	H 6
Banda (sea)	H 6
Bangka (arch.)	G 6
Bangka (isl.)	D 6

Banjak (isls.)	1,696	B 5
Barito (river)		B 5
Batjan (isls.)	21,861	H 5
Batu (isls.)	60,806	H 5
Bawean (isl.)	47,589	K 1
Billion (isl.)	97,487	D 6
Bone (gulph)		G 6
Borneo (isl.)		E 5
Buru (isl.)	16,018	H 6
Burung (isl.)	184,052	H 6
Celebes (sea)		G 5
Celebes (Sulawesi) (isl.)		G 5
Ceram (sea)	73,453	G 6
Damar (isls.)		H 6
Danar (isls.)		H 6
Engapao (isl.)	686	C 7
Ewab (Kai) (isls.)	76,606	J 7
Flores (isl.)	944,000	J 7
Flores (sea)		F 7
Halmahera (isl.)	97,133	F 7
Java (isl.)	54,475,638	L 1
Java (sea)		D 6
Java Head (point)		C 7
Kagean (isls.)	52,883	F 7
Kai (Ewab) (isls.)	76,606	F 7
Kajan (river)		F 5
Kalimantan (region)		F 5
Kapuas (river)	4,067,000	E 5
Karimata (arch.)	1,625	E 6
Karimata (strait)		D 6
Karimundjawa (isls.)	1,611	J 1
Kawio (isls.)		G 5
Krakatau (vol.)		C 7
Laut, Kaiti (isls.)	42,099	F 6
Leuser (mt.)		E 6
Lingga (arch.)	39,307	D 6
Lomblen (isl.)		D 6
Lombok (isl.)	1,252,157	G 7
Madura (isl.)	1,883,401	K 2
Madura (strait)		K 2
Makassar (strait)		F 5
Makassar (strait)		F 6
Mentawai (isls.)	23,649	B 6
Mentawai (isls.)	23,649	B 6
Molucca (isls.)		H 6
Molucca (sea)		H 6
Morotai (isl.)	19,523	H 5
Musi (river)		C 6
Natuna (isls.)	15,261	D 5

BRUNEI

Total Population	83,877
CITIES and TOWNS	
Brunei (cap.)	9,704

FEDERATION OF MALAYSIA

Total Population	9,741,950
STATES	
Sabah, 454,421	F 4
Sarawak, 744,529	E 5
CITIES and TOWNS	
Jessellton, 27,719	F 4
Kuching, 50,579	D 5

Nias (isl.)	224,169	B 5
Obi (isls.)	6,358	H 6
Penju (isls.)		H 7
Raja (mt.)		E 6
Rantokmbola (mt.)		C 5
Riau (arch.)	140,076	G 6
Roti (isl.)	68,330	G 8
Sanghne (isls.)	126,931	G 5
Sawu (isls.)	76,785	G 7
Semeru (mt.)		G 7
Siberut (isl.)	11,524	K 2
Slamet (mt.)		H 2
Solo (river)		J 2
South Natuna (isls.)	3,318	D 5
Sula (isls.)	30,779	H 6
Sula (Celebes) (isls.)		H 6
Sumatra (isl.)	14,207,000	G 6
Sumba (isl.)	268,544	E 7
Sumbawa (isl.)	450,778	E 7
Sunda (strait)		C 7
Talud (isls.)	28,738	H 5
Taninbar (isls.)	41,233	J 7
Timor (sea)		H 7
Toba (lake)		B 5
Tolo (gulph)		G 6
Tukangbesi (isls.)	59,775	H 7
We (isl.)	6,747	B 4
Weir (isl.)	11,383	H 7

PHYSICAL FEATURES

Iran (mths.)	E 5
Kinabalu (mt.)	E 5
Labuan (isl.)	F 4
Rajang (river)	E 5

TERRITORY OF NEW GUINEA

Total Population	1,386,808
CITIES and TOWNS	

Aitape, 161	B 6
Goroka, 1,973	B 7
Lae, 4,146	B 7
Madang, 1,550	B 6
Morebe	C 7
Wewak, 879	B 6
PHYSICAL FEATURES	
Huon (gulph)	C 7
New Britain (isl.)	81,194
Sepik (river)	B 6

PAPUA

Total Population	493,518
CITIES and TOWNS	

Abau	C 7
Daru, 237	K 6
Kerema, 282	B 7
Kokoda	B 7
Porembey (cap.)	C 7
Samarai, 777	C 8
PHYSICAL FEATURES	
D'Entrecasteaux (isls.)	29,322
Fly (river)	A 7

Louisiade (arch.)	10,384	C 8
Murray (lake)		B 7
Papua (gulph)		B 7
Torres (strait)		A 7
Trobriand (isls.)	9,134	C 7

PORTUGUESE TIMOR

Total Population	57,079
CITIES and TOWNS	
Dili (cap.)	1,795

PHYSICAL FEATURES

Oe-Cusse (reg.)	21,388	G 7
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WEST IRIAN

ak, 1,945	J 6
ana, 925	J 6
baru (cap.), 15,153	K 6
okwari	J 6
uke, 3,063	K 7
ng, 12,940	J 6

year from colleges and 240 from high schools set up by the Dutch in Indonesia.

Nationalism in the economic sphere in the 1950's had defined the major goal of economic policy: "sweeping away the vestiges of colonialism" and moving "from colonial economy to national economy" through "Indonesianization." The pressure on Dutch and Chinese business interests gradually increased, for instance, with the nationalization of the formerly Dutch-controlled Java Bank in 1953, with the preferences granted to Indonesian businessmen (as against foreigners) in the distribution of credit and import licenses, and with the abrogation of the Round Table Conference guarantees of Dutch investments in 1956. Then, in December 1957 virtually all Dutch enterprises were taken over, a somewhat unexpected climax to the violent agitation protesting the Netherlands' continued control of West New Guinea. The Indonesian government refused to discuss compensation for these properties (valued at approximately \$1 billion) until the West New Guinea question was negotiated.

The loss of a managerial and technical elite—about 45,000 Dutch persons left Indonesia following the 1957 take-overs—and the unexpected loss of Dutch-owned ships which carried 70 per cent of interisland trade (the Dutch owners succeeded in removing them from Indonesian control) had serious repercussions on the Indonesian economy, as did the disruptions of the 1958 rebellion.

The Chinese business community, always the object of nationalistic antagonism, suffered its first large-scale setbacks at the hands of the Indonesian government in 1958 and 1959. Because of alleged Kuomintang complicity in the 1958 rebellion, the government took over all businesses and organizations of the Kuomintang-affiliated Chinese, who numbered at least 100,000. A take-over followed in 1959 of some portion of the small traders and businesses operated by aliens, mainly Chinese, in most rural areas of Indonesia, a measure which in theory applied to upwards of 25,000 small businesses. Thus, in the period 1957–1960, economic nationalism produced what is perhaps the most important change in the Indonesian economy since 1945: replacing primarily alien control, in the "modern" economic sectors, with Indonesian control, replacing private ownership with public ownership. Enterprises remaining under foreign ownership included American private investment of more than \$500 million, concentrated in petroleum extraction.

By late 1958, the era of extensive government support to nascent Indonesian capitalists had passed. The former Dutch firms were placed under government ownership and management, and the stronghold of the indigenous capitalist, the import trade, was made a virtual state monopoly. The position of private entrepreneurs in Indonesia's socialist order was not precisely defined, but under the government regulations of April 1960 they were apparently to be largely subordinated to direct government regulation.

Serious shortages of the staple food, rice, occurring intermittently as in 1956 and 1958, were alleviated by large increases in rice importation, which sometimes equaled 10 per cent of annual domestic rice production (7-8 million tons). These shortages, mitigated only partially by United States surplus agricultural commodities assistance, necessitated the dangerous depletion of scarce foreign exchange reserves to finance rice imports. Beginning with the Agrarian Law of October



UPI Photo

A modern oil refinery at Balikpapan, in eastern Borneo.

1960, the government hoped to redistribute land-holdings, thereby diminishing inequity and exploitation, and encouraging greater production through a wider base of ownership. The most important provision of the law was that no landholding should be less than 4.94 acres. Family holdings might be as large as 49.4 acres, the limit being determined by the number of dependent family members.

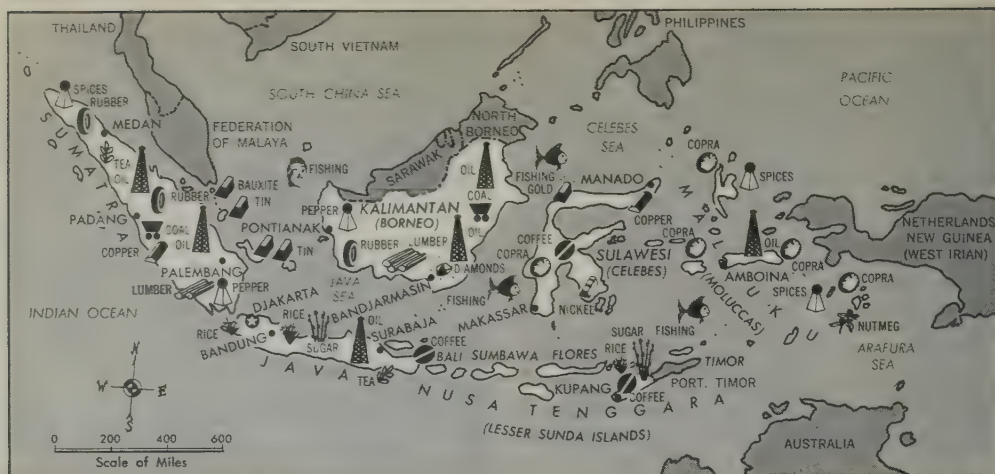
An eight-year plan, announced in August 1960, which set an extremely high target level of investment of about 15 per cent of national income, required more than doubling the investment rate of the most prosperous past years.

The shortage of domestic savings for financing rehabilitation and development has led the Indonesian government to accept extensive economic assistance from foreign governments. The total negotiated amount of foreign government economic assistance to Indonesia during the 1950's was more than \$1.5 billion—approximately half of which was utilized before 1960.

United States economic aid to Indonesia—loans, grants, and sales—totaled \$467 million between 1950 and 1960. Economic aid from Communist countries, begun in February 1955, totaled \$368 million by February 1960, most of which was still in the negotiating and planning stages. American economic aid emphasized technical training of indigenous personnel and social overhead capital—transport, power, communications. Communist aid, by contrast, stressed building of industrial plant and equipment.

Western European countries had loaned \$132 million to Indonesia up to January 1959. Japan and Indonesia agreed in 1958 on a World War II reparations payment totaling \$800 million, to be paid in loans and grants during 1958–1970.

Several hundred Indonesian military officers, beginning in 1951, received training under United States military aid programs, but Washington refused to provide substantial military equipment until after the Soviet Union had begun providing military equipment to Indonesia in 1958. By 1961 the Soviet Union had replaced the United States



Indonesia: Principal cities, products, and resources.

as the major supplier of equipment to the Indonesian armed forces.

In agricultural production for domestic consumption, rice predominates. Corn, cassava, sweet potatoes, peanuts, beans, squash, soybeans, sago, and coconut are also grown. The Western- and Indonesian-owned agricultural estates produce, mainly for export, rubber and sugar along with copra (dried coconut meat), coffee, tea, cinchona (for making quinine), tobacco, palm oil, kapok, cocoa, and various spices. The principal livestock for slaughter are cows and sheep; water buffalo, cows, and oxen are bred for draft animals.

The most important mineral extraction is of petroleum (on Sumatra, Java, Borneo, and Ceylon) and tin (on Bangka, Belitung, and Singkep). Bauxite and coal are mined in considerable quantities, along with small quantities of gold, iron ore, asphalt, manganese, copper, nickel, sulphur, and iodine.

DONALD POND,
Cornell Modern Indonesia Project, Cornell University.

5. CULTURAL ACTIVITIES

Education.—The expansion of education at all levels since independence is impressive. In 1958 there were more than 8 million students; 7.3 million in primary schools; 754,000 in secondary and vocational schools; and 38,000 in institutions of higher learning. More than 9 million people had received certificates from adult literacy schools. Literacy in Indonesia, estimated at 7 per cent in 1948, rose to 60 per cent by 1960. Regional languages and Indonesian are used in primary education; Indonesian in secondary schools, where English, the official second language, is introduced; and Indonesian, sometimes with English language textbooks or lectures, in higher education. The oldest institution is the University of Indonesia, consisting of a faculty of engineering (now the Technical Institute) founded in 1919 at Bandung, faculties of law (1924), medicine (1927), letters (1940), and economics at Djakarta, faculties of agriculture and veterinary science (1948) at Bogor, and several other faculties. Among six other state-sponsored institutions, the largest is Gadjah Mada

University, founded at Djokjakarta in 1949, with 13 faculties and 10,000 students. The others are Padjadjaran University (Bandung), Airlangga (Surabaya), Andalas (Bukittinggi, Sumatra), University of North Sumatra (Medan), and Hasanuddin (Makassar). Many of the private universities are associated with religious organizations. Teacher-training schools and many universities receive support from organizations of the United Nations, the Colombo Plan, the United States International Cooperation Administration, Ford and other private foundations, and missionary organizations.

Few large libraries exist in Indonesia. The leading ones are the former Royal Batavian Society of Arts library in Djakarta, a number of technical, research, and municipal libraries, the British and United States information services libraries, and several rapidly expanding university libraries. The principal museum, at Djakarta, houses Oriental art and ethnographical exhibits. The most notable of the other museums and parks are the Botanical Gardens at Bogor, established in 1817, housing many species of tropical vegetation and a presidential palace dating from the 18th century.

Architecture and Painting.—The architecture of Indonesia reflects its complex intermingling of cultures. The most impressive religious architecture was built in central Java: the Borobudur (q.v.), an 8th century Buddhist stupa; and the shrines at Prambanan, which represent the culmination of Hindu culture. Mosques reflect Middle Eastern influences and temples reflect early cultural contact with the Chinese. Most of the larger buildings indicate European sources. Many modern buildings have adapted regional forms, such as the gracefully distinctive saddle-shaped roofs and architecture of the Minangkabau or Batak peoples.

Two traditions intertwine in Indonesian painting: folk art and Eurasian art. Highly stylized Hindu-Indonesian folk art, depicting scenes of the great Hindu epics, has persisted for centuries in the villages, especially in Bali. Educated in Europe, Raden Saleh (1816–1880) was the first important Indonesian painter to use Western techniques. During the early 20th century, the

East Indian school evolved, focusing on the exotic appeal of Indonesia's landscape. The establishment in 1938 of the Association of Artists (PERSAGI) marked the beginning of truly national development, emphasizing self-expression. During World War II, the Japanese organized artists for propaganda purposes, and thereby contributed to their development. Among them Af-fandi (1910-), whose work is sometimes suggestive of German expressionism, is considered most accomplished. Since 1945 the principal art centers have been Djakarta, Bandung, and Djok-jakarta, where O. Effendi, Derachman, and Zaini have been leaders. Made, Reding, Tedjiwa, and Gendjot on Bali use a closely concentrated art form depicting rural scenes and people.

Music and Dance.—The highly sophisticated music of the *gamelan* orchestra is the traditional music of Java and Bali. It is characterized by scales of five notes each. Gamelan orchestras are used in traditional ceremonies and especially as accompaniments to *wajang* dances and puppet plays performed behind screens upon which shadows of the puppets are projected. These orchestras are composed largely of percussion instruments (gongs, drums, and xylophone- and marimbalike instruments) and are usually accompanied by singing. String and wind instruments are less prominent. Other traditional instruments used in outer islands include the *angklung* (a bamboo shake instrument), flutes, and various percussion and stringed instruments. Western instruments, especially the guitar, are now widely used to accompany folk dances and popular singing.

Among dances characteristic of Indonesia, those of Bali and Java are most popular. Performers wear traditional costumes and use highly stylized gestures and facial expressions similar to those shown in Hindu sculpture. Bali dances include the *legong*, performed by three girls; the *ketjak* or monkey dance; the solo *kebyar*; and the *djanger*, including both boys and girls. Typically Javanese are the *serimpi*, performed by four girls of noble birth (central Java); the *wajang orang*, a puppet dance (Surakarta); and the *tari topeng* (mask dance of west Java). Many other dances are indigenous to Sumatra, Kalimantan, Sulawesi, and eastern Indonesia.

Handicrafts.—Among the most striking handicrafts of Indonesia are the textile arts. Each region weaves its own distinctive cloth for daily or ceremonial wear, the latter often richly interwoven with gold thread. The batik or battik (q.v.) technique and the *ikat* technique (a process in which the threads are dyed before weaving to form a pattern) in central Java are unique. Woodcarving is highly developed in Japara (Djepara, central Java) and Bali. Besides utilitarian bowls, platters, and chests, figures of animals, people, ancient gods, or heroes, and masks for dancers are produced. Silverwork is a specialized craft in Djokjakarta, Java, Sumatra, southern Sulawesi, and Bali. Jewelry, utensils, and ornamental containers of intricate design are wrought, sometimes in silver filigree. Other handicrafts include weaving of baskets, sleeping mats, hats, and bags from rattan, palm leaves, and bamboo strips; beadwork to decorate bags, belts, and ceremonial ornaments or garments; leatherwork, frequently using alligator, snake, or lizard skins, for shoes, carrying cases, and other products; and ivory or horn, worked to make handles and sheaths of daggers, knives, and swords, and

small carved articles. Lamps, cooking utensils, and chests are made of brass, copper, iron, and aluminum, sometimes combined with wood.

Theater and Cinema.—The Indonesian theater consists primarily of the Hindu epic dance dramas. Most of the films shown are foreign, the majority coming from the United States, but with increasing numbers coming from Europe, the Soviet Union, and Asia. The Indonesian film industry began in 1950. During the 1950's, 8 studios and about 15 producers were making films accounting for 15 per cent of the screen time.

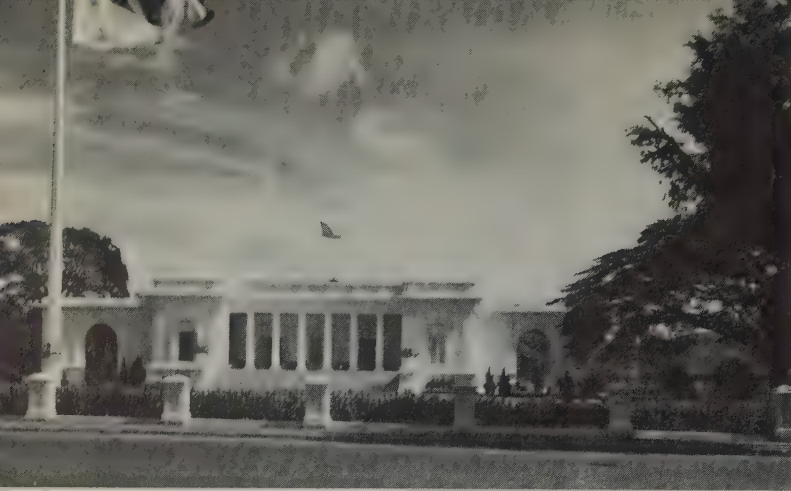
Literature.—The earliest Indonesian novels, published in the 1920's, were written by Merari Siregar (*The Miseries of a Young Girl*, 1922), Marah Rusli, and Abdul Muis. Indonesia's writers gained experience largely through journalism, and most of them still work as journalists. A Djakarta periodical, *Pudjangga Baru* (New Writers), started in 1933, supplied a name for the period of the 1930's. Its founders comprised two factions, one looking toward European, especially English, literature and the other toward Asian traditions. Amir Hamzah was the leading poet; Armijn Pané, the outstanding novelist of realism (*Shackled*, 1940); and Sanusi Pané, the most important playwright (*The New Man*, 1940). In the 1930's in Medan, an Islamic intellectual movement, coming from a less sophisticated background than that of the Djakarta writers, produced works emphasizing social progress, nationalism, and religious revival based on works in Arabic. A self-educated pro-Marxist group focused on problems of the proletariat. The Japanese occupation marked a period of transition, with academic titles tending to replace feudal titles as marks of status. Chairil Anwar, who died in 1949, was maturing as a poet of the Indonesian language. Also important were Usmar Ismail (plays, poetry), Rosihan Anwar (poet, newspaper editor), Abu Hanifah, Amal Hamzah, and Anas Ma'ruf. During the late 1940's a group of writers known as the "generation of 1945" emerged. Mochtar Lubis was among the most versatile of this group as a short story writer, novelist (*There Is No Tomorrow*, 1948), journalist, and editor (*Indonesia Raya*, 1950 to his house arrest in 1956). Others included Asrul Sani, Idrus, Pramoedya Ananta Toer (*The Guerrilla Family*, 1950), and Achdiat K. Mihadja (*The Atheist*, 1949). Too busy earning a living to concentrate on writing, most writers have turned to the short story. In 1959, Indonesia had 94 daily newspapers with a total circulation of over a million. See also JAVANESE—Literature.

WILLIAM A. WITHERINGTON.

6. GOVERNMENT AND POLITICS

Sovereignty passed to the United States of Indonesia on Dec. 27, 1949 and the army, youth groups, and secular nationalists quickly forced the dissolution of the Dutch-made *adat*-based member states, most of which were absurdly artificial, so that on Aug. 17, 1950 the restored unitary Republic of Indonesia was proclaimed, the fruit of five years of revolutionary struggle. But Indonesia was immediately faced with many complex political problems.

The government's attempts to channel the vast energies unleashed by the revolution in a constructive direction, and to modernize the highly heterogeneous and uncoordinated state bureaucracy met with little success. The political necessity of finding jobs for thousands of ex-revolutionaries



Freedom Palace, the stately presidential residence, in Djakarta, the capital city.

H. Armstrong Roberts

swelled an already unwieldy and undertrained civil service. The exigencies of the military struggle against the Dutch had prevented the imposition of effective central control over local and regional nationalist leaders. Inevitably, after the revolution, these regional authorities, though sincerely nationalist, were not eager to subordinate themselves to a centralized Djakarta-based regime.

Moreover the army, which had come to regard itself as the spearhead of the revolutionary regime, was unwilling to act simply as the obedient, nonpolitical servant of a rather humdrum civilian parliamentary government. The widespread decline of revolutionary unity and dynamism in Indonesia after 1950 deprived radical youth groups and other revolutionary elements of their *raison d'être*. And President Sukarno, with his vast energies, talents, and popularity among the common people, chafed under the largely ceremonial responsibilities which the parliamentary system assigned him.

As a result of these difficulties, a severe political crisis soon developed. Attempts to purge the army of revolutionary-minded but technically inefficient elements led to the so-called October 17th Affair, late in 1952. The Western-oriented group of politicians and army officers behind the purge tried to dismiss a recalcitrant Parliament by force, and suffered a decisive defeat when the president appealed to the public over their heads, and a rapid series of regional military coups took place in support of his action. The crisis seriously damaged the prestige and moral authority of the hitherto dominant section of the revolutionary elite, and exposed the fragility of the parliamentary system to many who were already dissatisfied with it. It also revealed the true political strength of the president and the army, who were thus encouraged to push forward to the center of the political arena, where the political parties had previously held sway.

The most important of these parties in the early parliamentary period were: (1) the Council of Indonesia, the Masjumi, consisting largely of modernist Islamic groups drawing strength from small-scale private business; (2) the Socialist Party (Partai Sosialis Indonesia, P.S.I.), a small elite group of highly influential Westernized intellectuals and politicians; (3) the Religious Teachers Party (Nahdatul Ulama, N.U.), an association of traditionalist, Javanese Islamic groups, with few strong ideological commitments,

but powerful because of its "swing" position in the center of the political spectrum; (4) the Nationalist Party (Partai Nasional Indonesia, P.N.I.), a Java-based mélange of civil servants, aristocratic *adat* elements, radical intellectuals, and prewar followers of President Sukarno, with whom the party closely identified itself in this period; (5) the Communist Party (Partai Komunis Indonesia, P.K.I.), also largely Javanese, based on a network of labor and peasant organizations, and, by 1953, largely recovered from the disastrous Madiun uprising.

The over-all trend in Indonesian party politics, at least until 1957, was a gradual leftward shift in the political center of gravity, as the early cabinets, dominated by a Masjumi-P.S.I. coalition, proved unable to cope with Indonesia's problems—at least over their rivals' opposition. One important landmark therefore was the formation in 1953 of Ali Sastroamidjojo's first government, from which the Masjumi and the Socialists were excluded. The new cabinet, composed mainly of P.N.I. and N.U. politicians, depended frequently on the support of the president and the Communists. The policies of the new ruling group differed from its predecessors' in two striking respects. In the economic field, it actively encouraged the development of an Indonesian business class, at the expense of Dutch interests. In foreign affairs, it veered sharply away from the cautiously pro-Western policy of the Masjumi and the P.S.I. to one of "positive neutralism" and a sustained effort to increase Indonesia's prestige and influence in the international world. The Afro-Asian Conference, held by Premier Ali's invitation at Bandung in the spring of 1955, was a triumphant climax to this campaign.

In its turn the new cabinet aroused considerable discontent. Its patronage policies hastened a secular decline of administrative integrity, and heightened a continuing struggle for power between the politicians and the professional bureaucracy. Economic policies, which inevitably appeared to favor overpopulated Java, helped to augment rising anti-Javanese sentiment, which had been largely latent during the revolution. The cabinet's attempts to tighten its grip on the discontented outer regions by administrative centralization (which benefited the predominantly Javanese civil service at the expense of local authorities) were strongly resented. The government's often openly political appointments and promo-



Roofed, gaily painted native craft swarm the Musi River at Palembang, Sumatra.

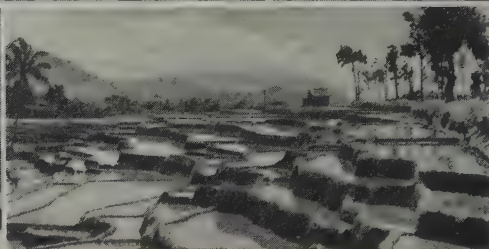
INDONESIA

Below: Outdoor marketing in equatorial Bukittinggi, Sumatra, the Fort de Kock of the Dutch colonial era.

Kodachromes by Robert Moore. © N.G.S.

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Top: Typical group of Indonesians in Djokjakarta, capital of the similarly named special district in Java. **Center row:** Ten-year-old Legong dancer of Bali; Balinese temple figure; rice terraces in Java. **Bottom row:** Batak village in northern Sumatra; the Traffic and Irrigation Building in Bandung, a fine example of modern Javanese architecture.

(Top) United Nations from Black Star; (center) Philip Gendreau; (others) Screen Traveler from Gendreau



tions within the army angered the high command. In the end, an army, not a parliamentary, opposition brought the cabinet down.

Nevertheless the parliamentary system survived, largely because many of those dissatisfied with it felt that it could not be condemned completely before nationwide elections had been held. The existing Parliament, with its large contingent of Dutch-appointed "Federalist" members, was generally regarded as unrepresentative and opportunistic. It was hoped that an election would simplify the party system, permit the formation of a dynamic and unified cabinet, and revive political morality and morale. Activist youth elements, alienated by the routine atmosphere of postrevolutionary life, found a new outlet for their energies and passions in the hotly contested year-long election campaign.

The elections, held late in 1955, unfortunately aroused exaggerated expectations. Though conducted with remarkable efficiency and fairness, the results did little to change the party system. While the Socialists suffered a crushing defeat, the Masjumi, the P.N.I., the N.U., and the Communists emerged with between one sixth and one fifth of the vote apiece. The Masjumi was shown to be the only party with substantial strength outside Java.

Mr. Sastroamidjojo's second cabinet, formed in the wake of the elections, was a decided anticlimax. All the familiar faces reappeared. The highly precarious coalition of antagonistic Masjumi and P.N.I. politicians was only too clearly a marriage of convenience against the growing power of extraparlimentary forces. Reactions were not slow in coming. Beginning in August 1956, a succession of coups, counter coups, and attempted coups in Java, Sumatra, Kalimantan, and Sulawesi reduced the government to almost complete paralysis.

By late 1956, a widespread feeling of frustration and deep discontent with the existing political system and the disastrous economic plight of Indonesia had undermined the prestige and morale of the parties, and simultaneously encouraged the ambitions of the army, and other antiparlimentary forces. President Sukarno found eager listeners therefore when, in February 1957, he announced his advocacy of a new political system—"guided democracy." This system called at first for an all-party national-unity cabinet including the Communists, working under the guidance of a national council, presided over by the president. The reaction of the non-Communist parties was naturally unenthusiastic. Accordingly Sukarno, in temporary alliance with the army leadership, took the cabinet's inability to solve the military and regional crisis as grounds for declaring martial law all over Indonesia. The local military commanders thus assumed virtually complete power in their areas. And in the capital, the president formed his own "nonparty" cabinet.

In itself the move did nothing to solve the general *crise de régime*, in which ethnic antagonisms, economic interests, religious animosities, ideological rivalries, and personal enmities were inextricably intertwined. Communist successes in the Java provincial elections held in the summer of 1957 increased internal tension and anxieties, particularly in the largely anti-Communist Outer Islands. An attempted assassination of the president and threats of mob violence against opposition Masjumi, Socialist, and other regional leaders in Djakarta were symptoms of a rapidly deterio-

rating situation which culminated in the outbreak of rebellions in Sumatra and Sulawesi in February 1958.

The effective military measures taken by Djakarta rapidly reduced the rebels to intermittent guerilla activity in the hinterland of Sumatra and Sulawesi. While the prestige of the president and the army were increased by their victory, the involvement of prominent Masjumi and Socialist leaders in the rebellion undermined their parties' political power, and led eventually to their proscription.

Three major centers of political power remained in the wake of the rebellion. Under martial law, the army assumed many of the powers and functions of the civilian bureaucracy. The expropriation of Dutch business assets in December 1957 allowed the army to move in and take control of a vast economic empire. While the N.U. and the P.N.I., ill adapted to Indonesia's new nonparliamentary form of politics, retired into the background, the Communist Party continued to rival the army's power, since it was tightly organized, ideologically cohesive, and undiscredited by corruption and previous tenure of governmental power. But it was President Sukarno, with his unique hold on the imagination of the common people, who remained the single most important political force in Indonesia, though his power was partly a function of his mediating position between the army and the Communists.

The reinstitution on July 5, 1959, of the Republican Constitution of 1945, granting the president near-dictatorial powers, merely added to the legitimacy of Sukarno's dominant position. The presidential palace, not Parliament or the cabinet, was the place where the major political decisions were made. A new, presidentially appointed Parliament showed little sign of life. In foreign affairs the new regime continued to develop the policy of nonalignment with either of the major world powers, and evinced an unprecedented determination and energy in pressing Indonesia's claim to sovereignty over Dutch-controlled western New Guinea. Internally, it was attempting to solve Indonesia's problems, and radically "retool" her entire political, economic, and social system within the centralized, authoritarian, and dynamic framework of "guided democracy."

B. R. O'G. ANDERSON,
Cornell Modern Indonesia Project, Cornell University.

7. HISTORY

Indonesian history falls into two very distinct phases. In the first of these, which runs from the early centuries A.D. up to the late 19th century, the huge distances of the archipelago, the small population, and the comparatively simple technology made it impossible for the area to enjoy any real degree of economic interdependence or political unity; the most one can say is that most of the islands were subject to the same external cultural influences and that certain parallels in the cultural patterns and economic and political history of the different parts of the archipelago are observable. In the second phase, beginning in the late 19th century, the impact of modern Western technology, organizational forms, and ideologies, associated with a huge increase in population, brought about the political unification of the area under Dutch rule and set the stage for the transfer of power to Indonesian hands.

Recorded history in the Indonesian islands begins in the first centuries A.D. with the coming of a wave of Indian cultural influence, the first of three such waves which have played a decisive part in Indonesian history. It is most probable that this Indian culture, Hindu or Buddhist, was first adopted by petty kings in many parts of the archipelago, who gained from it both magico-religious legitimation and practical tools—writing and bureaucratic techniques—on which they could build larger political units. Later this imported culture spread slowly downward in society, but it is significant that it pushed down deep roots only in areas of intensive wet rice cultivation, chiefly in the present day Javanese-speaking areas of Central and East Java.

In the 7th century appear the first larger Indianized states, Srivijaya, centered near modern Palembang, and a series of dynasties in central Java. Buddhist Srivijaya, which lasted until the 13th century, was the first example of one of the two main types of Indonesian states, a coastal principality, directly ruling only a small population, living on trade and naval power. Its fortunes, like those of its successors, depended thus on the fluctuations of, and balance of naval power along, the great Asian trade route which has flowed intermittently for two millennia through various parts of the archipelago on its way between China and India and on to the Middle East and Europe.

On the other hand, the central Javanese dynasties, like their successor states in Central and East Java, in areas of relatively large-scale wet rice cultivation, were based on bureaucratic or feudal control of land revenue and a large peasant labor force, such as was necessary to build the immense 8th century Buddhist shrine of Borobudur and the 10th century Hindu temple complex of Prambanan. The fortunes of this type of dynasty depended more on internal factors, chiefly its ability to keep subordinate lords, the Hindu and Buddhist and later Islamic orders, and peasants under central control.

From the 10th to the 14th century the seat of dynastic power on Java shifted to the east, to the Brantas River valley near modern Surabaya, culminating in the empire of Majapahit which in the 14th century controlled much of Java and claimed tribute from most of the archipelago. In this period, the interests of the land-based kingdoms turned somewhat toward the sea, as a rising world interest in spices sent an arm of the Asian trade route out through new ports in East Java to the spice islands of the Moluccas.

In the 15th century began the second great wave of outside cultural influence, that of Islam. At the beginning of the century Islam found acceptance in the growing port of Malacca, which was rapidly taking over the dominant position in the Straits long held by Srivijaya; and from Malacca it spread out along the trade routes. In East Java the port towns of Majapahit embraced Islam and broke away from the central control; in the spice islands themselves and elsewhere in the archipelago coastal rulers began to adopt the Muslim title of sultan. The process continued in the 16th century: the Portuguese captured Malacca in 1511 and for a half century maintained a precarious naval and trading leadership in the islands, but a strong Islamic reaction helped, to establish powerful trading sultanates in Atjeh on the northern tip of Sumatra, and Bantam on the Straits of Sunda.

As in the case of the earliest adoption of Indian culture, it seems likely that Islam was first taken up by princes of growing states to fortify themselves for their struggle with older Hindu-Buddhist powers or newer foreign ones, and only later began to spread among the ordinary people. It is in this second process, continuing into the 20th century, that Islamic culture has been most important in Indonesian history, for the spreading and deepening of Islam has highlighted or created many fundamental tensions in Indonesian society, tensions which are still critical today. Thus it is significant that Islam, though nominally accepted by some 90 per cent of modern Indonesians, has been shallowest in Central and East Java where Indian culture was already firmly established, and has struck its deepest roots in the Outer Islands. Everywhere its spread brought it into conflict with the traditions expressed in local customary law (*adat*) and everywhere Islamic preachers formed a focus of potential or actual opposition to local traditional authorities. Finally, in sinking roots in new soil, Islam has generally been split into two rival wings, the one willing to compromise with *adat*, the other purist or modernist.

The first Dutch ships arrived in the archipelago at the end of the 16th century and by dint of hard fighting the Dutch East India Company (1602-1798) maintained itself through the 17th century as the strongest single trading power in the area. Inevitably, to secure stability for trade and protect itself from attack, it found itself exerting influence in the hinterland of Java where the inland empire of Mataram, late 16th to late 17th century, had begun to disintegrate. By mid-18th century the company succeeded Mataram as the chief land power on Java. This process ran parallel with a growing change in its economic role; increasingly from about 1700 it lost ground in open trade to the British and came to rely on sugar and coffee grown in its Javanese territories, the latter especially produced by peasants under a system of forced deliveries controlled through a quasi-hereditary administrative system centering on the traditional local aristocracy.

The disruption caused by the Napoleonic Wars in Europe, which also provided the occasion for the dissolution of the company, completed the transformation of the Dutch Indies into a territorial power centering on Java, while the revival of the forced-deliveries system in 1830, now under the Dutch state, generated huge profits for the home treasury. The increase of production and population under this system laid the groundwork for further growth in the third quarter of the 19th century as the state withdrew gradually from production and trade, and private investment grew. The opening of the Suez Canal in 1869 was a still greater impetus to investment. Expansion had a geographic aspect as well. In the mid-19th century the Netherlands Indies for practical purposes was only Java; though the Dutch exerted a casual dominance in the archipelago, dozens of small and large kingdoms maintained their independence in practice and often in theory. The Outer Islands campaigns of the late 19th and early 20th centuries, by which the Netherlands Indies assumed its modern boundaries, were stimulated mainly by economic interests and were consolidated by a tightening of administrative control and an expansion of investment.

The new Netherlands Indies which took form

in the early 20th century was, consciously and unconsciously, well adapted to dampen change. The economy was mostly based on plantation production (sugar, coffee, tea, rubber) and mineral extraction (tin and oil) for export, while industry was poorly developed. The "plural economy" of which the Netherlands Indies was a classical example, with European managers, Chinese middlemen and shopkeepers, and Indonesian clerks and laborers, was an effective insulator not least because European and Chinese interests made development of an Indonesian commercial class almost impossible. Above all, the general administrative system, based everywhere on traditional *adat* authorities—in the Outer Islands mostly indirect rule through chiefs and sultans, in Java nominally direct rule, but operating through the traditional local aristocracy—exerted a conservative influence, while in the village sphere Dutch paternalism combined the encouragement of slow progress with an effort to insulate the villager from the disruptive effects of new social and economic forces.

But the hugely expanded boundaries, production, technology, and population of the new Netherlands Indies of the early 20th century made social change inevitable and so began the third and most revolutionary wave of cultural influence, of Westernization. Nowhere was this more obvious than in the development of a new Indonesian elite, mainly secular and nationalist, in the early decades of the 20th century. This new urban elite, professional and bureaucratic rather than commercial, was a product of the modern Western education system which the Dutch had begun to develop around 1900; in Dutch schools it found the new ideas and ideals on which to base its claim to political leadership, not only against the Dutch but also against the older *adat* and Islamic elites. Growing quietly in the turbulent early years of the nationalist movement in which moderate and radical Islamic groups, Communists, and narrow-based ethnic groups all showed that they did not have the organization or ideology to lead a national awakening, this new elite emerged in the late 1920's and 1930's. The demands of its more militant wing for independence were soon muffled by Dutch repression and exile, but a much larger wing found expression through politically more moderate parties, newspapers, co-operative societies, and independent schools which testified to the increasingly solid social base of the new elite.

On March 9, 1942 the Netherlands Indies came to an end with a hasty surrender to the invading Japanese. Three and a half years of Japanese occupation brought disruption, starvation, and slave labor but politically it opened the doors to revolutionary change, for the Japanese, hoping to arouse mass support for their cause by encouraging Indonesian nationalism, deliberately destroyed all the insulators in the conservative Dutch colonial system. They gave Indonesian civil servants high responsible jobs, gave considerable power to the secular nationalist and Islamic elites while cutting deeply into the power and prestige of the *adat* leaders, they armed and trained thousands of young men on Java and Sumatra and, most important, by a ceaseless battering of propaganda, much of it nationalistic, and by promoting dozens of activist organizations, they set out to rouse the peasant masses from their political unconsciousness.

On Aug. 17, 1945, directly after the Japanese

surrendered, Sukarno and Mohammad Hatta, acting for the nationalist elite which had gained key positions under the Japanese, proclaimed the independence of the Republic of Indonesia. A constitution, a cabinet, and the choice of Sukarno as president and Hatta as vice president followed shortly. British troops, representing the Allies, began arriving in late September and their coming opened the first and most violent phase of the revolution.

The Indonesian revolution must be seen as the working out of two parallel processes, one international, the other internal. In its international aspect the revolution was a process by which the bulk of the Indonesian elite asserted and finally won its right to replace the Dutch. In principle every Republican cabinet claimed complete independence but was prepared, under pressure of Dutch military superiority and international demands for compromise, to negotiate; Dutch policy was to force or persuade mainly *adat* groups in the various regions to cooperate in the formation of member states in a Dutch-dominated federal system and to use these new states and military force to isolate and ultimately destroy or absorb the Republic. The landmarks of this international conflict were: the Linggadjati Agreement signed in November 1946 and ratified in March 1947 (cease-fire, federal system with republic as largest unit, *de facto* recognition of republic); the first Dutch "police action" July–August 1947 (West and East Java and economically important areas of Sumatra occupied); United Nations intervention leading to the Renville Agreement January 1948 (cease-fire ratification of Dutch conquests, ambiguous Dutch commitment to organize plebiscites); rapid development of Dutch-sponsored federal system in 1948; 2d Dutch "police action" December 1948 (occupation of virtually all of the republic's remaining territory, capture of most of its top civilian leaders, commencement of widespread guerrilla war by the Indonesian Army); further negotiations under United Nations auspices with international opinion and important elements within the federal member states swinging toward the republic, culminating in the Hague Agreement in November 1949 (transfer of sovereignty to a federal Indonesia with the republic as one member state, temporary retention of West New Guinea by the Dutch, Republican guarantee of Dutch investments in Indonesia).

In its internal aspect the revolution was first of all a tremendous outpouring of idealistic fervor, devoted to the development of a unitary national state based on social justice and democracy and its preservation from foreign attack. At the same time it involved a fierce struggle for power among conflicting elite groups and considerable brutality and violence, particularly against Chinese. The overriding political issue throughout the revolution was the question of whether and how far to compromise with the Dutch; the diedarh slogan of 100 per cent independence, unanswerable in terms of revolutionary ideology, was always raised by parties and factions when out of power, such as in the abortive Communist rebellion (the Madiun affair) in September 1948, and remained a permanent article of faith with most of the younger activists.

Finally the revolution effected a considerable change in the balance of power among the competing elite groups: thus *adat* groups continued to lose status and power as under the Japanese

and tended to be responsive to Dutch overtures; secular nationalists took over most important civilian posts and through various rival parties dominated the legislature and cabinets; the Islamic elite divided between a majority which joined the secular nationalists in giving priority to national independence and a militant minority unreconciled to the secularist constitution. The rise of the younger "generation of 1945," the element most active in fighting and internal reconstruction, added a fourth major elite group to the triangle. The national army was the foremost institutional form of this new elite, exercising considerable de facto power throughout the revolution.

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INDORE, in-dōr', city, India, capital of Indore District in Madhya Pradesh, and formerly capital (from 1818) of the princely state of Indore. Indore State consisted of a number of non-contiguous areas, totaling 9,934 square miles, with a population (1941) of 1,513,966. The largest, most compact portion of its territory lay south of the Narbada River, overlapping the Satpura Range, while the portion containing the present district and city lay northward along the Vindhya Range and the Malwa Plateau. The state had its origin in several grants of land made in the early 18th century to the heroic peasant-born cavalry

officer, Malhar Rao Holkar, in the service of the Maratha peshwa; at Malhar's death in 1766 his domain stretched from the Deccan to the Ganges. In 1818, by the Treaty of Mandasor, it became a British protectorate and was stripped of considerable holdings, especially in Rajputana. In 1948, following Indian independence, Indore merged with other princely states into the new state of Madhya Bharat, which in turn was merged into Madhya Pradesh in 1956.

The present district of Indore, 1,563 square miles, mainly on the Malwa Plateau, is a fertile agricultural area specializing in cotton. The city of Indore is among the leading commercial and cotton-milling centers of central India. Pop. of the city (1961 provisional) 395,035.

JOSEPH E. SCHWARTZBERG.

INDRA, in'drū, a Hindu deity who is king of the pantheon in the Rig Veda, but in the epic is ruler of a heaven of sensual pleasures to which brave warriors go, and in the Puranas is a rain god of minor importance. He appears to personify the force lying in atmospheric phenomena, the wind and the storm, and has such epithets as "Son of Might" and "Lord of Power." His parentage is obscure, but he seems possibly to have been the son of Heaven and Earth, who once lived together but were driven apart when Indra drank of the marvelous Soma and swelled to gigantic and terrifying size. His great feat lay in slaying the archdemon Vritra (Vrtra), "the Covering or Restrainer," who held in confinement the Cosmic Waters (described as cows) and their son the Sun, which were needed to give moisture and light, elements necessary for the creation of the universe. Indra slew Vritra with a weapon called vajra, which was forged by Tvashtri (Tvastṛ), the artificer of the gods. This is interpreted in post-Vedic thought as the lightning, but some Western scholars have thought that in Vedic times it was understood to be a club. Vritra is interpreted in later times as the cloud covering that obscures and withholds the rain and sun. Jainism and Buddhism know Indra as a *deus ex machina*, who aids in events of cosmic importance connected with their great teachers and saints.

W. NORMAN BROWN.

INDRE, än'dr', department, France, in the west central part of the country, comprising parts of the old provinces of Berry, Orléanais, Marche, and Touraine. It has an area of 2,666 square miles and is watered by the Indre and Creuse rivers. The capital is Châteauroux; other important towns are Issoudun, Argenton, and Le Blanc. Indre is mainly agricultural, with textile, leather, and iron manufactures. Pop. (1954) 247,436.

INDRE-ET-LOIRE, än'drā-lwār', department, France, in the west central part of the country, formed out of most of the old province of Touraine and parts of Poitou and Anjou. Its area of 2,378 square miles is watered by the Loire, Indre, Cher, and Vienne rivers. Wine making is the chief industry. Tours is the capital; other towns are Chinon and Amboise. Indre-et-Loire has several famous Loire Valley châteaux. Pop. (1954) 364,706.

INDUCTANCE, in-dük'tāns, that property of an electric circuit or of two neighboring cir-

cuits which determines how much electromotive force (volts) will be induced in one of the circuits by a change of current (amperes) in either of them. Inductance is measured in henries and designated by the letter L . An electric circuit has an inductance of one henry when, if the current is changed at the rate of one ampere per second, one volt is induced in the circuit thereby. It may be measured by an inductance bridge which is similar to a Wheatstone bridge used for measuring resistance. The inductance bridge compares the unknown inductance with a known inductance standard. The inductance of a circuit may be

determined from the formula $L = \frac{X_L}{2\pi F}$ where

6.28 is 2π and F is the frequency or cycles of the circuit and X_L is its reactance in ohms. For example, the inductance L would equal 0.0595 henries in a 60 cycle circuit containing 22.45 ohms of

reactance, X_L , as $L = \frac{22.45}{6.28 \times 60} = \frac{22.45}{376.80} = 0.0595$

henries. Inductances connected in series equals their arithmetical sum. When connected in multiple, inductance $L = \frac{1}{\frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3}}$, etc. The term

henry was given the unit of inductance L in honor of Joseph Henry (1797-1878), whose investigations gave the world much of its present knowledge on the subject.

INDUCTION, in-dŭk'shŭn, *in logic*, is the method of reasoning employed in establishing general laws as well as propositions about individual occurrences on the basis of specific observational evidence. The intellectual operations involved in grounding Boyle's law upon actual measurements on the volume, pressure, and temperature of gases; the prediction of tomorrow's weather on the strength of meteorological data; or the determination of the circumstances of Lincoln's death on the evidence of documents and other available materials, are typical examples of inductive reasoning. In this inclusive sense of "induction," it is not antithetical to deduction, since the deductive elaboration of propositions is a feature of nearly all inquiry. Inductive and deductive inferences can nevertheless be distinguished. In valid deductive arguments, the premises logically imply or necessitate the conclusion, and constitute formally complete evidence for the latter. In inductive arguments, the premises do not necessitate the conclusion, they are not formally sufficient to establish it, but they make the conclusion probable (or warranted) to some degree. The statement that all acids turn blue litmus paper red, for example, is not logically implied by the evidential premises which express the outcome of a finite number of observations on the color changes of blue litmus in the presence of acids. The statement nevertheless possesses a measure of probability relative to those premises.

It is essential to distinguish between induction as an inclusive process of experimental investigation and discovery, and induction as that phase in this process which consists in the weighing or evaluation of the available evidence for a given conclusion. An account of induction as a concrete temporal process seeks to formulate the major steps in the pattern of inquiry: the recognition of a problem, the invention and formulation of a hypothesis as a proposed solution for it, the derivation of deductive consequences of the hy-

pothesis, the verification of some of these consequences through confronting them with data of observation or with other propositions already assumed as well-established, and the acceptance, modification, or rejection of the hypothesis in the light of the outcome of the preceding step. Such an account usually includes discussions not only of distinctively logical questions, but also of various psychological and sociological factors that may determine the direction of inquiry. Much of the literature on induction thus pays attention to the personal and social requirements for effective research, to the role of intellectual fashions and preconceptions in the development of knowledge, to techniques of observation, and to proposed ways for obtaining successful solutions to problems.

In connection with this last item, many writers on induction have sought to state general rules of experimental method, adherence to which would guarantee the discovery of the causes and effects of phenomena. The best-known of such rules are the five "Methods of Experimental Inquiry" proposed by John Stuart Mill in the 19th century. According to the Method of Agreement, if two or more instances of a phenomenon have but one circumstance in common, that circumstance is the cause (or effect) of the phenomenon. The Method of Difference states that if an instance of a phenomenon has every circumstance but one in common with an instance in which the phenomenon does not occur, that sole circumstance is the cause (or effect). The Joint Method of Agreement and Difference is a combination of the two preceding methods. According to the Method of Concomitant Variation, if variations in one phenomenon are concomitant with variations in another, the two phenomena are causally related. Finally, the Method of Residues states that if part of some phenomenon is known to be the effect of certain of its antecedents, the remainder of the phenomenon is the effect of its remaining antecedents. These canons have not, however, proved to be rules which can disclose the causal relations of things, unless the canons are supplemented with assumptions specific to a given subject of inquiry. The application of each method involves the use of some hypothesis concerning the circumstances that are relevant to the occurrence of a phenomenon under study, where the hypothesis itself cannot be extracted from any general rules of procedure, but must be supplied by the wit and the imagination of the individual investigator. With this important qualification, however, Mill's methods do formulate patterns of analysis employed in many experimental inquiries. They codify the ideal logical conditions of experimental study; they specify standards for judging the adequacy of causal imputations, even though modern experimental science is not primarily a search for "causes"; and they indicate the rationale for testing, and when necessary eliminating, hypotheses about dependencies between phenomena. But the methods are rules neither for inventing hypotheses nor for discovering such dependencies; and adherence to them does not guarantee the truth of hypotheses that have not been eliminated as erroneous.

Induction as the weighing of evidence for a given conclusion must, however, be distinguished from various other operations employed in inquiry. The problems raised by the question whether a given conclusion is adequately supported by a given body of evidence, for example, are of a

different order from those raised by the question how evidence has been or can be obtained, or by what train of thought a proposed solution to a difficulty has been reached. The distinctively logical problems of induction lead to two related groups of inquiries: to the formulation of the principles explicitly or tacitly involved in evaluating formally incomplete evidence for a stated conclusion; and to the "justification" (or validation) of these principles.

The principles studied in inductive logic are those underlying *ampliative* inference, that is, arguments where the conclusion is not logically entailed by the evidential premises. So-called "perfect" (or "summative") induction, in which a universal conclusion is based on a supposed exhaustive enumeration of its instances (that is the claim that all the planets move on elliptic orbits around the sun, on the strength of examining each of the planets *seriatim*), is a trivial instance of deduction, and plays no significant role in empirical inquiry. Moreover, the development of modern science has made highly doubtful whether there is such a thing as "intuitive induction" (traditionally regarded as the primary source of scientific knowledge), in which relations are allegedly apprehended as universally and necessarily valid by contemplating a few of their instances (for example, the alleged intuitive apprehension of the truth of the law of inertia). Ampliative inferences nevertheless differ widely in respect to the form of both their conclusions and evidential premises, and three major types are sometimes distinguished: the affirmation of a universal law or theory, on the basis of samples drawn from the population of things for which the law supposedly holds; the prediction of the composition of an unexamined sample, on the strength of the known composition of examined samples; and the imputation of some trait to an individual, on the basis of an assumed analogy between that individual and others known to possess that trait. Accordingly, the systematic presentation of the principles involved in evaluating the various arguments subsumable under these types is a difficult task. It is a task which inductive logicians have not yet completed.

It is customary to say that the conclusion in an ampliative inference is no more than "probable" on the evidence available for it. Much effort has in fact gone into the codification of the principles governing such inferences within the framework of a theory of probability. Indeed, repeated attempts have been made to apply the mathematical calculus of probability to the numerical evaluation of inductive evidence. In recent years, moreover, advances in theoretical statistics have supplied important clues to the logical structure of inductive arguments, and have contributed valuable rules for estimating the risks involved in accepting or rejecting various types of hypotheses on the strength of the statistical evidence for them. The success of these attempts to subsume inductive logic under the theory of probability is nevertheless still a moot question. There is considerable disagreement among competent students on the correct analysis of the notion of probability; and there is no unanimity among them on the relevance or applicability of many theorems in the calculus of probability to the evaluation of inductive evidence. For example, to illustrate this latter remark, according to Pierre Simon de Laplace's famous Rule of Succession, if an event (that is, sunrise every 24 hours) is known to have

occurred n times without failure, the probability of its occurrence on the next occasion is $(n+1)/(n+2)$. Although the rule is a necessary consequence of Laplace's assumptions, most contemporary students nevertheless regard some of those assumptions as inapplicable to the great majority of inductive inquiries.

Despite the unsettled state of the subject, however, there appears to be good agreement on a number of central points. It is generally recognized that the weight of the evidence for an inductive conclusion depends on the degree to which the evidence is a representative sample from the total population of relevant data for that conclusion. In weighing such evidence consideration must therefore be given to the number of independent items included in the evidence, to the variety of evidential data, to the sampling procedure adopted in gathering the evidence, and to the systematic interconnections of the stated conclusion with more inclusive assumptions for which other independent evidence is available. For example, a few careful measurements suffice to fix with high probability the approximate value of the density of a newly synthesized substance, although a large number of confirmatory observations may not establish a high probability for the conclusion that all crows are black. The rationale for this comes from the circumstance that the constancy of the density of a chemically homogeneous substance is required by a comprehensive theory of matter, for which there is a vast accumulation of independent evidence, but that a constant association of the color of plumage with anatomic or physiological structure is not entailed by any established biological theory. A very large number of observations on crows is therefore needed to make sure that the observed crows are a representative sample from the crow population. Space forbids, however, a fuller discussion of the details of inductive logic.

The second question to which the analysis of inductive inference leads is that of "justifying" them. Many writers have sought to find a deductive justification, which would establish the validity of inductive arguments by demonstrating that, granted the evidential premises, the conclusion either must be true or be true with some specified probability. To achieve this end, a comprehensive assumption is generally introduced as an additional premise for all inductive arguments, so as to convert the latter into deductive ones. A premise of this sort frequently proposed is the Principle of the Uniformity of Nature, which asserts that "what happens once, will, under a sufficient degree of similarity of circumstances, happen again." But quite apart from difficulties of detail, there is the fundamental objection that a deductive justification of induction postulates an irrelevant standard of validity for the latter. Many students have therefore abandoned the quest for a deductive justification as radically mistaken. Some of these have in fact taken the position that in no sense whatever can inductive arguments be justified, since the rules underlying such arguments are merely tacit definitions of what constitutes "reasonable" evidence. This view, however, is not easily compatible with the generally admitted fact that some inductive procedures are more effective than are others in achieving the ends of inquiry. Another group of students, finally, also regard attempts at a *wholesale* justification of induction as misplaced effort. These students seek, nevertheless, to assess the relative worth of various

specific forms of inductive inference, in terms of the actual successes in the past of those arguments in yielding reliable conclusions to determinate problems of inquiry.

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INDUCTION, in physical science, the process by which an object is electrified, magnetized or given an induced voltage by exposure to a field, but without direct contact. The principle of electromagnetic induction was discovered by Michael Faraday (1791–1867) in 1831 and has proved the greatest of all discoveries in electrical science. It is the basis for the generation of commercial electricity as used throughout the world. Faraday had spent nearly 11 years trying to find a more satisfactory source of electricity than that produced by crude inefficient batteries. Faraday's discovery was that electricity may be generated by moving an electrical conductor in a magnetic field. This is the principle upon which the dynamo or generator is founded. (See GENERATORS, ELECTRIC; ELECTROMAGNETISM.) It is known as electromagnetic induction. Electromagnets are used almost entirely to supply the magnetic flux for the generation of electricity. Permanent magnets are only used on small generators, often referred to as magnetos. Magnetic induction covers the attraction or repulsion of magnetic materials such as iron and steel by either a permanent or by an electromagnet. The term induction applies here as attraction or repulsion and takes place through space as no contact is required.

Electrostatic or Statical Induction (also called **Electric Induction**).—An object is charged electrically by bringing it into an electrical field of an already charged object. The capacitor operates on the principle of electrostatic induction. It is due to the principle of electrostatic induction that an alternating current will flow through a capacitor. A direct current will cause electrostatic induction in a capacitor only at the time of connecting the capacitor to the circuit. This is called charging the capacitor. This charge will remain in the capacitor until the capacitor is discharged or lost by leakage. A direct current will not pass through the insulation of a capacitor. It should be noted that an alternating current passes or flows through the capacitor only by induction through the insulating medium of the capacitor. The alternating current has movement by varying in intensity and direction while direct current remains constant except at the instant its circuit is closed or opened.

Mutual Induction.—The production of a voltage, electromotive force, in one electric circuit by varying the current in an adjacent circuit is mutual induction. The magnetic flux or field produced by an electric current flowing through a conductor or coil always spreads out symmetrically and more or less uniformly to form closed magnetic paths. If any of this flux or magnetic lines pass directly through other conductors or a second coil the flux will be mutual to both coils. By mutual induction an electromotive force, volt-

age, will be produced in the other conductors or coil, as the case may be, provided there is movement of the flux. Mutual induction is the principle upon which automatic control devices, induction motors and transformers operate. (See TRANSFORMER.) It should be noted that an electrical contact between conductors or coils is not necessary to establish mutual induction.

Self-Induction.—Briefly stated, self-induction is the production of a voltage in a circuit by varying current in that same circuit. If an electric current passes through a conductor it sets up a magnetic field around the conductor. If this current, amperes, changes in value, the magnetic field, flux, produced by the current will also change. This change in flux will produce a voltage within the conductor and this voltage is the voltage of self-induction. (The subject of self-induction is closely related to that of inductance and should be jointly considered. See INDUCTANCE.) The voltage created by self-induction is opposite in direction to the original voltage applied to the conductor. When a circuit is supplied with direct current self-induction is present only at the moment when the circuit is closed. After the circuit is closed and the current is steady there is no movement of the magnetic field or flux. Self-induction is present in any circuit containing magnetic equipment when supplied by an alternating current. Such circuits are said to be inductive. Such currents are varying constantly and thus create a changing flux which in turn creates an opposing voltage, the voltage of self-induction.

E. S. LINCOLN.

INDUCTION, Mathematical, is a process of proof applying most directly to theorems about the collection of all *natural numbers*:

0, 1, 2, 3, . . .

When it is required to prove a general proposition:

For every natural number n , $P(n)$,

the use of mathematical induction consists in proving instead both the general proposition,

(1) For every natural number n ,
if $P(n)$, then $P(n+1)$.

and the singular proposition,

(2) $P(0)$.

The adequacy of such proof rests intuitively upon the fact that each of the propositions:

If $P(0)$ then $P(1)$,
(3) If $P(1)$ then $P(2)$,
If $P(2)$ then $P(3)$,
etc.,

is a consequence of the general proposition (1) and that the propositions:

(4) $P(1)$, $P(2)$, $P(3)$, etc.

follow successively, one by one, from propositions (3) and proposition (2). In brief, the general proposition warrants inference from *each* special case to the *next*, while the singular proposition states the first case outright. Assurance is thus obtained that *every* special case can be proved.

As an example, proof by mathematical induction that:

For every natural number n ,

$$1 + 2 + 4 + \dots + 2^n = 2^{n+1} - 1,$$

consists in showing:

(1') For every natural number n , if

$$(a) 1 + 2 + 4 + \dots + 2^n = 2^{n+1} - 1$$

then

$$(b) 1 + 2 + 4 + \dots + 2^n + 2^{n+1} = 2^{n+2} - 1;$$

$$(2') 1 = 2^1 - 1.$$

Proof of (1') is made by starting with equation (a), adding 2^{n+1} to both sides, and obtaining thereby equation (b), since $2^{n+1} - 1 + 2^{n+1} = 2^{n+2} - 1$.

This form of argument is also known as *proof by recursion*, *complete induction*, *finite induction*, and—in German writings—*proof from n to $n+1$* . These names are likewise given to various related but more complex forms of argument.¹

Principle of Mathematical Induction.—Consider any property of natural numbers and suppose that:

- (1) If any natural number n has the property then its *successor* $n+1$ also has the property (the property is *preserved under succession*),
- (2) The number 0 has the property.

Then:

Every natural number has that property.

This is the *principle of mathematical induction*. It ascribes to the system of natural numbers a special structure in terms of the notion of successor, by virtue of which structure proof by mathematical induction—and definition by induction (cf. below)—is sound and adequate.

In the axiomatic treatment of arithmetic by Giuseppe Peano (1858–1932)²—in which *natural number*, *zero*, and *successor* are primitive terms—mathematical induction is secured by taking this principle as one of the axioms. In the Gottlob Frege-Bertrand Russell derivation of arithmetic from logic³—in which *cardinal number*, *zero*, and *successor* are all defined in terms of logical notions—the natural numbers are defined to be the *inductive* cardinal numbers, that is the common part of all collections of cardinal numbers which (1) whenever they contain any cardinal number also contain its successor (collections *closed under succession*) and (2) contain the number 0. In this context the principle of induction can be *proved* of the natural numbers by virtue of their definition. In an axiomatic treatment of the system of *real numbers*,³ the collection of natural numbers can again be distinguished by essentially this same definition, and the principle of induction proved of the natural numbers as defined.

The intuitive justification of the principle may be put in these terms: The system of natural numbers is generated in its normal order of magnitude from the number *zero* solely by the process of *succession* (as in the act of counting). The premises of the principle insure that the property

in question belongs to zero and that, as each number is generated, it must belong to that number since preserved under succession. Hence, there being no other natural numbers than those generated in succession, the property belongs to every natural number.

It is apparent from the foregoing that the appellation, *mathematical induction*, is a misnomer. Mathematical induction is a thoroughly deductive process—in some contexts the principle is itself demonstrable—remote from any conception of induction found in the empirical sciences. Nor does it represent an inference from particular to general, but rather inference of one generality from another (and a particular).

Well-Ordering Principle.—The structure of the system of natural numbers is such that it can be said of any two numbers which is the smaller. The system is thus an *ordered* system in which 0 is the least element and, for any number n , n is less than $n+1$. In terms of this order relation, the basis of mathematical induction can be put in perhaps its most compelling form:

In every (non-empty) collection of natural numbers there is a least number. By virtue of this property, the collection of all natural numbers is said to be *well-ordered*. The principle of induction follows readily from the well-ordering: Let P be a property satisfying the principle of induction; if there are any numbers for which the property P fails, let $n+1$ be the least such number ($n+1$ because 0 is *not* a number for which P fails). Then the number n (less than $n+1$) has the property P , hence so does $n+1$, which is a contradiction. Hence there are no numbers for which the property fails.

A proof by mathematical induction may also take the form of proving that:

For every natural number n , if the property P holds of every natural number less than n then the property P holds of n itself.

(This includes the case that P holds of 0, since there are no natural numbers less than 0.) The soundness of this procedure follows immediately from the fact that the natural numbers are well-ordered. Indeed this procedure, although in the case of the natural numbers it is equivalent to process of inference originally stated, is in other contexts much more powerful. It applies, under the name of the principle of *transfinite induction*, to proofs in the theory of *transfinite numbers* and to proofs about the elements of any collection which can be well-ordered. It has been a matter of controversy among mathematicians whether every collection can be well-ordered (the *well-ordering principle*), that is, whether this strong kind of induction can be applied to arguments about any collection whatsoever; the predominant opinion is that it can.

Definition by Induction.—The sense of the operation of *multiplication* (of natural numbers) is expressible by the pair of equations:

$$a \times (n+1) = (a \times n) + a; a \times 0 = 0.$$

Using the notation n' (instead of $n+1$) for the successor of n , the equations take the form:

$$a \times n' = (a \times n) + a; a \times 0 = 0.$$

Addition may be similarly defined by:

$$a + n' = (a + n); a + 0 = a.$$

These are examples of *definition by induction* or *recursive definition*. If the numerals, 0, 1, 2, 3,

¹ A number of interesting illustrations of proof by mathematical induction will be found in Courant, R., and Robbins, H., *What is Mathematics?* (New York 1941).

² Russell, B., *Introduction to Mathematical Philosophy* (London 1919).

³ Graves, L. M., *Theory of Functions of Real Variables* (New York 1946).

etc., be understood as abbreviations of the signs, $0, 0', 0'',$ etc., then these definitions accomplish the explanation, for example, of 2×2 , stepwise in terms of 0 and successor: $2 \times 2 = (2 \times 1) + 2 = ((2 \times 0) + 2) + 2 = (0 + 2) + 2 = (0 + 2)' = (0 + 2)'' = (0 + 1)''' = 0''' = 4$.

The technical notion of *general recursive function*⁴, of which the above are two special cases, is defined as follows: A finite set, ε , of equations determines a general recursive function, $f(x_1, x_2, \dots, x_n)$, if for every set, $X_1, X_2, \dots, X_n$, of numerals there is exactly one numeral Y such that the equation, $f(X_1, X_2, \dots, X_n) = Y$, is obtainable as the last of a finite sequence of equations, each of which is either one of the equations of the set ε or itself obtained from earlier equations of the sequence by:

- (R1) Passage from an equation, $A = B$, containing a *variable*, say y , to the equation which results from $A = B$ by substituting a numeral, Y , for y throughout;
- (R2) Passage from an equation, $A = B$, containing *no variables* and an equation of the form $g(X_1, X_2, \dots, X_k) = Y$, where $X_1, X_2, \dots, X_k, Y$, are numerals, to the equation resulting from $A = B$ upon replacing one or more occurrences of $g(X_1, X_2, \dots, X_k)$ in B by Y .

In the case of addition, an appropriate set ε is:

- (1) $S(a, n') = (S(a, n))'$
- (2) $S(a, 0) = a$.

The finite sequence of equations to show that $1 + 2 = 3$ (i.e., that $0' + 0'' = 0'''$) continues:

- (3) $S(0', 0) = 0'$ by (R1)
- (4) $S(0', 0') = (S(0', 0))'$ by (R1)
- (5) $S(0', 0'') = (S(0', 0'))'$ by (R1)
- (6) $S(0', 0''') = ((S(0', 0''))')$ by (R2)
- (7) $S(0', 0''') = ((0'))' = 3$ by (R2)

To show that this or any set, ε , of equations does in fact define a general recursive function is of course a matter for proof by mathematical induction. The question is whether such a set, ε , permits computation for *all* natural numbers as arguments, as this set has been seen to do for 1 and 2.

The distinguishing feature of general recursive functions, which gives them their importance in logic and foundations of mathematics, is that the value of such a function for any particular arguments can be explicitly computed in a finite number of steps. They are therefore capable of explicating the notion of *effective process* or *constructive method*.

In symbolic logic it is required that there be an effective criterion to recognize whether a given sequence of symbols is a sentence or whether a given sequence of sentences is a proof. By associating numbers with sequences and symbols an effective criterion to recognize a sentence may be identified with a general recursive function whose value is 0 for such numbers as are associated with sentences and is 1 for all other numbers. Demands of the *mathematical intuitionists* that all mathematical proof be by means of constructive methods can be made precise by identifying such methods as those for which an associated general recursive function can be provided.

Several other, independently proposed, expli-

cations of the notion of effective process⁵ have been proved equivalent to general recursiveness, which suggests that all these equivalent explanations are fundamentally correct. The identification of the vague notion of effective process with the precise notion of general recursiveness has for the first time allowed the proof that for certain problems no effective process of solution exists; e.g., in symbolic logic, while effective criteria exist whether a sequence of sentences is a proof no such criterion exists beyond an elementary level for whether a given sentence is a theorem.

Mathematics and Logic.—At a time when the syllogism was accounted the only significant tool of logical demonstration, mathematical induction appeared to transcend the bounds of logic by requiring an infinite sequence of hypothetical syllogisms in its employment. It was thought in consequence to be the distinctive mark of mathematical reasoning.⁵

The development of logic to the level which permitted the Frege-Russell reduction of mathematics to logic issued, on the one hand, in a definition of natural number, of which definition the principle of mathematical induction is a purely logical consequence, and on the other, in the systematic use of mathematical induction in the investigation of questions which would appear to be clearly within the province of logic.⁴ The use of mathematical induction will thus no longer serve to distinguish these two disciplines, if they are two.¹

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INDUCTION BALANCE, an instrument for measuring the electrical conductivity of metals which operates upon the basis of counterbalancing two induced electrical currents. It was originated by Heinrich Wilhelm Dove in 1841 and improved as a practical device by David Edward Hughes in 1879. Essentially it consists of two sets of induction coils. A current of electricity from a battery passes through both of the primary circuits of the two induction coils, and, in addition, through a circuit breaker. A current is induced and flows in the secondary coils when that in the primaries is rapidly made and broken. The two primary coils are connected to the battery in such a manner that the current flows through them in opposite directions. Thus the induced currents traversing the two secondary coils also flow in opposite directions. If, therefore, a telephone is inserted in the circuit of the secondary coils the buzz resulting from the make and break of the primary current will be heard in the telephone so long, but only so long, as the two currents are unequal in potential; if the two currents are equal they neutralize one another and no sound is audible. Suppose that this latter condition prevails. If, now, a piece of metal is placed near *one* of the pairs of coils the primary circuit of this coil will act upon the metal giving rise to induced currents within the metal and this affects the induced (secondary) current of this one coil. As a result the two secondary currents are no longer equal and a sound in the telephone notifies the experimenter of this fact. In such a manner a piece of metal, a bullet for example, may be detected in the human body without recourse to

⁴ Kleene, S. C., *Introduction to Metamathematics* (New York 1952).

⁵ Poincaré, H., *Science and Method* (New York 1952; original French ed. 1908).

X-ray photography. An induction balance for this purpose was designed by Alexander Graham Bell and later was employed in an attempt to locate the bullet which caused the death of President Garfield in 1881.

Diversity in the intensity of the induced currents, and therefore of the sound emitted by the telephone, depends not only upon the mass of the interfering metal and its position in relation to the two sets of induction coils, but, in addition, upon the particular electrical conductance of the metal in question. It follows that the induction balance may serve to measure the specific conductance of a given metal; employed in this manner the instrument is known as an induction bridge. The induction balance furthermore may be used to measure the sense of hearing, the perception of sound being determined while varying the positions of the coils; thus used the instrument is known as an audiometer.

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INDUCTION COIL, a device used for changing a low-voltage direct current into a high-voltage alternating current. Its general construction consists of a round bundle of fine iron wires, the core, wound with a few turns and layers of comparatively large copper conductor, primary, over which are wound many turns and layers of fine copper conductor, or wire, secondary, as shown in the illustration. The primary winding is connected in series with a vibrating contact shown at the right in Fig. 1. This vibrating contact actuated by magnetism in the magnetized core opens and closes the primary current and induces by mutual induction a current in the

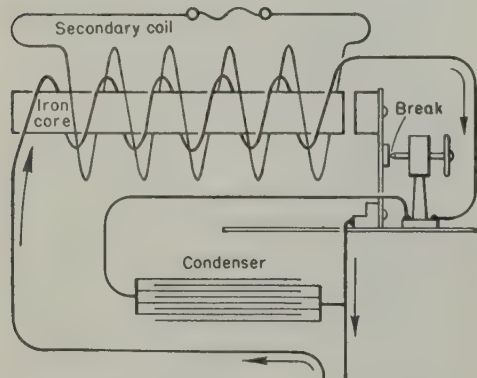


Fig. 1. Diagram of an induction coil.

secondary winding or coil. Sparking at the contacts is reduced by a condenser or capacitor connected across the contacts (as shown in Fig. 1). When the contacts open the primary circuit the winding quickly discharges its current into the capacitor. This in turn causes a quick collapse of the magnetic field produced by the primary and causes a high voltage to be induced in the secondary circuit. Induction coils have been built for producing sparks ranging from a fraction of an inch up to several feet in length. Induction coils were in common use before the alternating current transformer took over the field of producing high voltages. However, the induction coil is used for providing the ignition spark necessary

to operate the engine in the automobile. The induction coil receives direct current from the storage battery in the automobile and steps it up to a high voltage. This high voltage jumps the small gap in the spark plugs and ignites the gasoline mixture in the engine cylinders. The induction coil without its vibrator is also used in telephone instruments.

INDUCTION COMPASS, an instrument also known as earth inductor compass. Its indications depend on the current generated in a coil of wire revolving in the magnetic field of the earth.

INDUCTION FURNACES. See FURNACE—4. *Electric Furnaces.*

INDUCTION GENERATOR. If an induction motor is operated by mechanical means at a speed higher than its rate, synchronous speed, it will act as a generator. It cannot, however, act alone as a generator and can only generate electricity when connected to an electrical system also supplied with power from regular or standard synchronous generators. This is due to the fact that an induction generator must receive its field excitation current from the system to which it is connected. In order to produce such an excitation current, a leading current must be taken from an induction generator. This means a capacitive load from static condensers (capacitors) or synchronous machines connected to the system. The speed of the induction generator does not determine the frequency (cycles) of the system to which it is connected. Such frequency must be provided by the synchronous generators connected to the same system. (See GENERATORS, ELECTRIC.) In certain applications of electric locomotive operation, by induction motors, their action as a generator by overspeeding is utilized as a braking or speed-reduction means for the locomotive.

INDUCTION HEATING. See FURNACE—4. *Electric Furnaces.*

INDUCTION INSTRUMENT, an instrument or meter, as it is usually called, which depends for its operation upon the induction between a magnetic flux (or fluxes) set up by one or more currents in fixed winding or coils, and electric currents set up by electromagnetic induction in conducting parts of its moving system. A good example of an induction meter is found in the so-called watt-hour meter found in practically all homes using alternating current. It is the meter used for determining how much electricity has been used in the home and provides the basis for the cost of electricity used.

INDUCTION MOTOR. See ELECTRIC MOTORS.—*Alternating Current Motors* (Induction Motors).

INDUCTION REGULATOR, a device used to regulate the voltage of a system independent of the generator supplying the system voltage and current. A good example of its use is in the supply of electricity in residential districts. Here the induction regulator is used to boost or increase the voltage to homes when the load is heavy and to decrease the voltage when the loads are light. In other words its object is to main-

tain a constant voltage on a distribution system or feeder regardless of the load. Induction regulators work on the principle of the transformer, having a fixed primary coil and a movable secondary coil. The movable secondary coil is designed to either add or subtract from the system voltage anywhere from 0 to 15 per cent of the normal voltage supplied to the regulator. A lineman would call such action "boosting" or "bucking" the line voltage.

INDUCTIVE INTERFERENCE. When an alternating current power line runs parallel to a telephone line it will, under certain conditions, interfere with telephone conversations in the telephone lines. In the early days of the alternating current lighting systems it put many telephone systems out of use. This was due to the induction of currents from the power system inducing interfering currents into the telephone system. (See **INDUCTION**.) Such objectionable interference has been eliminated by transposing wires in both systems so as to equalize the currents in all telephone wires. The transposing of wires means exchange of location or the crossing from one insulator to an adjacent insulator on a telephone pole cross arm. Running wires in cables with metal sheaths, or coverings, which are grounded, has entirely removed inductive interference.

INDUCTIVE LOAD, a load on an electric circuit containing magnetic or inductive equipment. The cause of an inductive load is inductance in the circuit. An inductive load is sometimes called a lagging load, as the current in the circuit lags behind the voltage impressed upon the circuit. (See **ALTERNATING CURRENT**.)

INDUCTOR-TYPE GENERATOR is an alternating current generator in which the armature and field are both stationary. The stationary field magnetizes a rotating inductor which in turn causes magnetism to pass through the stationary armature conductors or coils. Such inductor alternations were used in the early development of alternating current systems. This type of generator is now used for obtaining high frequency (3,000 to 10,000 cycles) currents for use in induction heating furnaces.

INDULGENCE, ĭn-dŭl'jĕns (Latin, *indulgentia*, gentleness; hence concession and pardon), is defined by the Roman Catholic Church as "the remission before God of the temporal punishment due to sin after its guilt has been forgiven, which ecclesiastical authority grants from the treasury of the church, in behalf of the living after the manner of an absolution, and in behalf of the dead after the manner of an intercession." (*Code of Canon Law*, Can. 911.) Certain terms in this definition and certain related doctrines must be explained for an understanding of indulgences.

An actual sin is any willful thought, desire, word, action, or omission forbidden by the law of God. A grievous, or mortal, sin deprives the soul of sanctifying grace, and consequently of its right to everlasting happiness in heaven, and takes away the supernatural merit of its good actions. Venial sin does not destroy sanctifying grace. In addition to guilt for having offended God, the sinner incurs punishment for his misdeed. Eternal punishment is the everlasting loss brought upon himself by one who has committed a mortal sin

and dies unrepentant. Temporal punishment, or that limited in duration, is due for venial sins and for mortal sins that have been pardoned but for which further satisfaction must be made. The doctrine of indulgences refers neither to the pardon of mortal or venial sin nor to the remission of eternal punishment. It is concerned only with the temporal punishment still due either for venial sin or for mortal sin that has been repented for and pardoned by God. The reality of such punishment is seen from Sacred Scripture (Deuteronomy 32:51-5, 2; II Kings 12:13-19; Matthew 3:8; Luke 3:3), the tradition of the church, and natural reason. In the primitive church severe canonical penances were imposed on those guilty of serious sin. Since God's justice requires reparation for wrongs done, the repentant sinner who has failed to pay his debt of temporal punishment in this life will be required to do so after death in purgatory (q.v.).

The church, the Mystical Body of Christ, is made up of the visible church with its members here on earth (the church militant), the souls in purgatory (the church suffering), and the saints in heaven (the church triumphant). As in a living organism, one member can aid another who needs help. Within the church militant, members help one another by prayers and good works. They invoke the intercession of the saints in heaven, who in turn help them. They help the suffering souls in purgatory by prayers and by performing good works in their behalf. The treasury of the church is made up of the infinite merits of Jesus Christ and the superabundant merits of the Blessed Virgin Mary and the saints. It draws upon this inexhaustible storehouse and enables the faithful on earth to lessen their own debt of temporal punishment and also that of the souls in purgatory. An indulgence is therefore a transfer of some of the merits of Christ and the saints from this spiritual treasury to the faithful. As such, it is an exercise of "the power of the keys," granted by Christ when He said: "Thou art Peter, and upon this rock I shall build my church, . . . And I will give thee the keys of the kingdom of heaven; and whatever thou shalt bind upon earth shall be bound in heaven, and whatever thou shalt loose upon earth shall be loosed in heaven." (Matthew 16:19.) As successor of St. Peter, the pope has full power to grant indulgences, and those that he grants to the universal church can be gained by all Roman Catholics.

Indulgences are of two main kinds, partial and plenary. Since a partial indulgence is the remission of some of the temporal punishment due for sin, it is expressed in terms of time. Thus a partial indulgence may be for "100 days," "one year," or some other stated time. Such terms are relative and are not to be understood in a literal sense, as if the indulgence is good only for a certain period or remits exactly that period in purgatory. The use of these terms derives from the canonical penances of the early church. Thus a partial indulgence of 50 days signifies that it is the equivalent of a similar period of penance in the early church. A plenary indulgence remits all the temporal punishment still due for a person's sins. Although a person cannot affirm absolutely that he has fulfilled all the requirements for a plenary indulgence, yet "a plenary indulgence is understood to be so granted that if one should be unable to gain it fully, he will nevertheless gain it partially, in keeping with the disposition that he has." (Canon 926.)

That a person may be capable of gaining an indulgence, he must be baptized, not excommunicated from the church, in the state of sanctifying grace, at least when he completes the prescribed good works, and the subject of the grantor of the indulgence. He must also have at least a general intention of acquiring the indulgence. The prescribed works must be fulfilled at the appointed time and in an appropriate manner. To gain a plenary indulgence, a person must be completely free from all his sins without exception, including his venial sins. No one who has gained an indulgence can apply it to another person who is still living, but all indulgences granted by the supreme pontiff, unless the contrary is evident, are applicable to the souls in purgatory, who are thus helped in a most efficacious manner. As stated in their definition, indulgences are applicable to the faithful departed "by way of intercession," that is, the church petitions God to accept these works of satisfaction and to shorten the temporal punishment in purgatory as He sees fit.

Indulgences are frequently attached to prayers, religious exercises, visits to churches, pilgrimages, and similar good works. During the Middle Ages they were often attached to such works of charity as contributions to building hospitals, bridges, and churches, and in this way they had great social influence.

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INDULGENCE, DECLARATION OF.

See DECLARATION OF INDULGENCE.

INDUS, in'dūs, an important river of southwestern Asia. Rising in the lofty tableland of Tibet not far from the source of that other major Indian river, the Brahmaputra, it flows for some distance in a northwesterly direction at an elevation of nearly three miles. Crossing the towering Ladakh ranges, it traverses matchless scenery within 60 miles of K², the loftiest summit of the Karakoram Range, to swirl about the base of Nanga Parbat, the westernmost bastion of the Himalayas. This peak, rising nearly 23,000 feet above the current, presents the greatest contrast in neighboring elevations to be found anywhere. Flowing through Baltistan and Kashmir and swollen by the meltings of giant glaciers, the Indus bends to the southwest to be joined by the more extensive rivers of the Punjab—the Jhelum, the Chenab, the Ravi, and the Sutlej. Skirting the Thar or Indian Desert, it loses much volume to scorching winds and still more to the irrigation canals and ditches which nourish that arid region. In its course of 1,976 miles, it drains an area of 372,000 square miles to empty by several mouths through a delta fronting for 130 miles upon the Arabian Sea.

The Indus is turbulent in flood time. At Attock it has risen more than 80 feet so that the Kabul tributary reversed its current to flow backward into Afghanistan. While volume varies, the average flow at Sukkur as recorded by the Indus

River Commission during a period of 50 years is 155,000 cubic feet per second. Enormous quantities of silt are swept away to expand the ever growing delta. During the three-month period of maximum flow, this silt totals six billion cubic feet.

Indus is derived from the Sanskrit Sindhu, meaning river. From the same root comes India and the Indian Ocean. Further ramifications of nomenclature embrace the East and West Indies and the Indians of the Western Hemisphere, so that the name of no other river has been so variously repeated upon the maps of the world.

The Indus was well known to the ancients. It was sketched with tolerable accuracy by Eratosthenes and Ptolemy, although its source remained hidden beyond the mountains. Alexander the Great sailed down its channel to the sea. Aristobolus wrote that a thousand Indian cities had been abandoned because the Indus had shifted its course. Within the past two centuries it has eroded its present bed through limestone ridges three hundred miles from the sea. The seven mouths enumerated by Ptolemy have also changed through the centuries as former channels were choked and new ones opened up.

Like the Nile and the Euphrates, the Indus was the cradle of prehistoric cultures. The ruins of Mohenjo-Daro and Harappa, recently unearthed in its valley, were among the earliest of city states. Here, so Sir John Hubert Marshall (1876–) claims, living conditions excelled those of contemporary Egypt and Babylon.

Though traversing some of the most rugged country in the world, the upper Indus Valley has always been the "gateway to India." Through its precipitous passes came the conquering Aryans and the exploring armies of Alexander the Great, to be followed by ruthless Moslem raiders, by Genghis Khan, Tamerlane (Timur), and the great Moguls.

With the partition of India into two sovereign states, the valley of the Indus is once more the scene of strife and disagreement. The status of Kashmir is still undetermined. While the main stream of the Indus lies within Pakistan, the boundary between that country and India crosses several important tributaries. Hence, disputes persist over the sharing of irrigation waters so vitally needed in an agricultural area and the development of hydroelectric power in a region almost destitute of coal.

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INDUSTRIAL ACCIDENTS. See ACCIDENTS, CAUSES AND PREVENTION OF—*Occupational Accidents*.

INDUSTRIAL ALCOHOL. See DENATURED ALCOHOL.

INDUSTRIAL ARBITRATION. See ARBITRATION, INDUSTRIAL.

INDUSTRIAL ARCHITECTURE is that branch of building that houses the production of man-made commodities. As such it includes power plants, mills, and factories of all types. By extension, it may comprise also those edifices provided for the convenience of the industrial workers, offices for the administrative staff, warehouses for the storage of finished goods or raw materials, and such others as are corollary to the industrial process. So long as production remained in the

handicraft stage, and was consequently carried on in the home of the worker, no architecture of industry as such was possible. However, with the advent of power to run machinery, the industry of the home began to give way to that of the mill and factory, and industrial architecture was born. Its needs were and are utilitarian. Economic pressure insured that designing for visual effect would be subordinate to designing for use. Therefore, the influence of historic styles in architecture could play only a minor role. The absurdity of clothing a power plant with details derived from a Greek temple, or a locomotive works as a Gothic church, was too costly to be tolerated, though the shape of the tower from the Palazzo Pubblico, Siena, of the late 13th century, was draped around a certain 19th century factory chimney in London. It does not follow that industrial buildings need to be ugly, but that their beauty must issue from a frank acceptance of their purpose unclouded by nostalgic references to the past.

The first requisite for a successful industrial building is the selection and development of the site. The choice of the site will be conditioned by the product to be manufactured. Transportation for the necessary raw materials and for the finished product will suggest proximity to water, rail, road, or, in the 20th century, air routes, depending on the nature of the finished article. The particular manufacturing process may prescribe a location adjacent to a source of power. Thus many of the early mills were built where rivers could be dammed for water power. Hydroelectric plants are necessarily so placed today. The availability of such public services as electricity, gas, sewage, and water supply are prerequisite; without them, their cost must be added to the price of the product. Where large numbers of workers are expected, some means of public transportation or of roads and adequate parking facilities to bring them to and from their work forms part of the problem unless housing is to be provided for them close to the factory. The nature of the soil conditions as they affect the cost of the buildings, of normal atmospheric conditions that may influence some manufacturing processes, of local building laws are other factors. In addition, the relation of the proposed enterprise to the community must be considered. To place a slaughter house or a boiler plant in the midst of a high-class residential area would be destructive to that area no matter how desirable the site might be in other respects.

The nature of the particular manufacturing process involved will dictate the arrangement of the building. The designer must be so conversant with this process that his building will promote an uninterrupted flow from the reception of the raw material through perhaps many machines in orderly sequence to the emergence of the finished product. He must provide space enough for adequate and safe operation of the machinery but not so much as to involve waste of time. He must provide such electrical, gas, water, fire-fighting, heating and ventilating, cleaning, and internal communication facilities as are appropriate. The materials selected for the building stem from its nature. Floors that must withstand the wear of interior trucking must not only be heavier than normal in construction but surfaced accordingly. They may need to be resistant to chemical action and should be easy to keep clean. The latter may be especially significant where the product involves close tolerances. Finally, the

welfare and comfort of the workers are important. This factor was not always recognized in the older mill designs, but 20th century industry realizes that, in addition to humanitarian considerations, the physical and mental well being of the worker affects his efficiency. Hence lighting, whether artificial or natural, must be abundant but without glare. Sound-absorbent walls and ceilings may reduce excessive noise. Cleanliness and effective ventilation help to preserve the health of the operatives. Industry has even experimented with the psychological effects of interior colors and finishes. In addition, it has provided, at times, first aid and other medical offices, cafeterias or dining rooms, lounges, dressing, locker, and shower rooms for its staff, athletic facilities, and even kindergartens and supervised playgrounds for the children of its employees while the parents are at work.

In view of the utilitarian nature of industrial buildings, it is not surprising that the potentialities of new materials and methods of construction were more eagerly accepted in them than in traditional types of building. Before iron became available for construction at low cost, and for many years thereafter, slow burning or mill construction was common. Its purpose was to minimize losses by fire. Brick walls or a frame of timber posts supported heavy wooden beams. These carried thick plank floors and similarly solid roof construction. Although the material was inflammable, the absence of enclosed spaces, such as exist in ordinary wood construction, made it difficult for fire to spread, and since all surfaces were exposed, if fire should start, it could be controlled rapidly. The strength of iron invited its use for industrial designs, and as early as 1780, cast iron columns began to replace wooden posts in English cotton mills. Matthew Boulton and James Watt took the next step in 1801 in the Philipp and Lee cotton mill at Salford, Manchester, England, where they combined iron floor beams with cast iron columns. Brick arches spanned the intervals between beams to support the floor. Then in 1848 in New York, James Bogardus built a five-story factory whose outer walls were made of precast iron sections. Jules Saulnier in 1871-1872 devised the first metal skeleton, fully braced, whose brick walls merely filled the interstices in the frame. This step, so prophetic for later skyscraper construction, was made in the Menier Chocolate Works at Noisiel-sur-Marne, a building erected over the bed of the river whose current provided the necessary power. Meanwhile, builders were beginning to experiment with concrete. In 1824, Joseph Aspdin patented Portland cement. Then in 1854, W. B. Wilkinson in England patented (the patent was sealed in 1855) a system of constructing floor slabs, girders, and beams with iron rods or wires embedded in the concrete to provide tensile strength. Wilkinson specifically recommended his method for warehouses. This was followed by a treatise on concrete, published in 1761 by François Coignet, who is said to have built a concrete roof slab at St. Denis as early as 1852. The latter half of the 19th century saw many patents issued for various forms and applications of concrete, such as those of Joseph F. Monier (1867), and Coignet (1869).

The advantages that may accrue from these developments were not available when the first factories were built or even for the earliest extant mills. The oldest cotton mill still standing in the United States is the Slater Mill, Pawtucket, R. I.

(1793). Though larger than contemporary private houses, its clapboarded walls, double-hung window sash, and severe cornice at the eaves of a pitched roof recall the domestic architecture of its day. However, all decorative detail was suppressed save for the belfry, and even that was necessary to summon the workers to their posts. Early in the 19th century, rubble masonry began to replace wood for the outer walls. As it did so, the scale became larger and less domestic. By the middle of the 19th century, brick walls were thickened between the windows to become piers and to express the mill construction within, as in the White Rock Manufacturing Company, Westerly, R. I. (1849). The range of the Amoskeag cotton mills along the river in Manchester, N. H., is impressive. By 1870, the date of the Lippitt woolen mill, Woonsocket, R. I., brick piers supported granite lintels of wide span to approximate a skeleton construction; windows were larger and although the mansard roof smacked of the Vic-

form an intelligent expression of concrete. Vast expanses of glass flood the interior with light. The great hall interior is high, not for architectural effect though it has that too, but to permit of overhead traveling cranes for the placement and repair of the machines. The same consideration operates in such hydroelectric power plants as that at the Hoover Dam. Modern installations, especially those publicly owned, provide for visitors in such a manner that they will not interfere with the operation of the plant. Few buildings better suggest the titanic forces generated within than the concrete and steel masses of the Cahokia Power Station, East St. Louis (c.1925) by Mauraan, Russell, and Crowell, where four pairs of ponderous smokestacks create a powerful rhythm. Recently forced draft has replaced stacks, in part because of their danger to air traffic. The influence of the assembly line is apparent in the five story Fiat automobile factory, Turin, Italy, designed by Matté Trucco. Spiral ramps at either



Lady Esther, Ltd. office and factory erected in Chicago 1937-38; designed by Albert Kahn Associated Architects and Engineers.

torian, it created a spacious and well lighted attic story. Prior to the factory system, the workers had been scattered among their own homes, but when mills began to require perhaps hundreds of operatives who could not live far from their work, the industrialists had to house them. Many of the early 19th century mill villages were composed of individual houses for families or of boarding houses for unmarried workers, simple and unpretentious, but not necessarily crowded and as well equipped as ordinary homes of the time. The housing of the Amoskeag cotton mills, Manchester, N. H., was excellent, while charming mill villages shaded with elms are scattered through Rhode Island and Massachusetts. The slums, commonly associated with company housing, are generally later in date.

One of the first modern factories was the AEG¹ turbine factory, Berlin (1909), designed by Peter Behrens. Its simple but powerful masses

end of this quarter-mile-long building facilitate a continuous process of manufacture and assembly from the entry of raw materials on the ground floor to the finished cars on top. One may drive through the whole factory; even the roof is used, as a testing track for the product. The concept of the wall as a skin to exclude weather instead of a necessary support for the floors and roof has been made possible by steel or concrete construction. Peter Behrens and Alexander Popp placed all the supports inside the walls of the Linz factory (1934) for the Austrian State Tobacco Monopoly, so that unbroken strip windows light each of the six floors. This outer skin is carefully insulated to maintain the even temperature and humidity required for the product. Bright colors enliven the interior, while medical offices, a restaurant, baths, and a kindergarten provide for the welfare of the workers. Even more striking is the printing plant for the *Daily Express*, London, where H. O. Ellis and Clarke separated their strip windows with bands of black

¹ Allgemeine Elektrizitäts Gesellschaft.

glass. They also installed at the top a track to hold running cradles when the facing or the windows need cleaning. All these buildings except the power plants have been several stories high; multistory buildings occupy less land and cost less to construct than single-story buildings of the same floor area. Nevertheless, for many manufacturing processes the advantages of conducting all the operations on a single floor may overcome the higher cost of land and building. The Lady Esther, Ltd., office and factory, Chicago, designed by Albert Kahn, illustrates this trend to single-story buildings.

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INDUSTRIAL ARTS EDUCATION. Industrial arts education is the broad study of the materials, organization, tools, processes, products, jobs, and human problems of industry. It has also been defined as a study of the changes made by man in the forms of materials to increase their values, and of the problems of life related to these changes. As such, industrial arts education is essentially a phase of the general education of every individual who lives in an industrial society. It is that aspect of general education which deals with industry and with the problems that emerge from the dynamic nature of an industrial and technological society. Industrial arts education is not to be confused with industrial education, technical education, or with the generic term vocational education. These terms are used to identify that special education whose controlling purpose is gainful employment, or the preparation for specific jobs in industry.

Educators have carefully set forth the aims and objectives of industrial arts education. The objectives are specific and they are conceived of in terms of desired behavior changes that should take place in the thought and action patterns of those who experience the activities of the industrial arts laboratory or shop. Among the objectives most commonly listed are the following: (1) to satisfy that creative desire in every person to construct something with tools and materials; (2) to develop basic skills in the use of the more common tools and machines, together with a knowledge of the working characteristics and uses of industrial materials; (3) to develop the ability to do simple repair and maintenance work in the home; (4) to afford opportunities to discover individual aptitudes, abilities, and interests in trade and industrial occupations; (5) to offer an interesting and challenging field of possibilities for the development of worthwhile leisure-time activities; (6) to assist in a more intelligent and discriminating selection, appreciation, and use of industrial products and services; (7) to develop an appreciation of appropriate design, sound construction, and good workmanship; (8) to develop habits of orderly methods of procedure in planning and performing tasks; (9) to develop an appreciation of the importance of the concept of work and a respect for honest, careful, and effective work; (10) to develop an active interest in industry and industrial life as a vital approach to an under-

standing of contemporary life; (11) to offer opportunity for the practical applications of mathematics, science, and drawing; and (12) to contribute to the enrichment of all learning activities in the total program of general education.

Industrial arts education, under a variety of names, has had a long history of development and its present position in the school program rests upon four fundamental postulates. Briefly stated these include the following: (1) that a study of the nature and needs of individuals is basic to a sound program of education; (2) that a study of the material culture of American society is a perspective through which great world civilizations can become more meaningful; (3) that a study of the socio-economic forces and conditions which characterize present-day industrial society is vital to an understanding of some of the perplexing problems of contemporary life; and (4) that a study of educational thought and practice through the ages reveals much concerning a philosophy of work and of the nature of handwork and creative activity with tools and materials as strong supports of a balanced education.

Industrial arts education emerged from what is often termed manual training. The emphasis of manual training was on hand skill, chiefly in woodworking. Exercises in wood and in metal characterized manual training and the program reverted often to the practice of some few skills that were believed to have direct vocational bearing. As part of the manual arts movement in education in the last decades of the 19th century shop work in the schools still emphasized manual skills directed to the making of both useful and well designed articles, still principally by hand. This phase of the development of what is now called industrial arts education was tremendously influenced by the introduction of sloyd work from Sweden into the United States by Larsson in Boston in 1888. Following the introduction of manual arts work into the schools came considerable work in the arts and crafts. The phenomenon of industry, however, was not injected into manual arts education. It was not until after the turn of the 20th century that such educators as Charles Russ Richards, James Earl Russell, and Frederick Gordon Bonser began to talk of industrial arts education as a broad orientation or exploration of the world of contemporary work. Industrial arts education calls for a diversity rather than a specialization of skill. Many materials were suggested for use in connection with the introduction to the basic techniques employed in industry.

The program of industrial arts education in the modern elementary school becomes that of aiding the classroom teacher with the many problems relative to developing integrated activity programs. Here the curriculum evolves from the many factors of daily living and rotates around such experiences in child life as food and clothing, or the home and community life. Activities are many and varied and include such things as manipulating, experimenting, building, constructing, reporting, observing, and visiting. Such activities might include the many problems involved in planning and constructing a miniature airport or producing and staging a puppet show.

The adolescent age of the junior high school, the level on which industrial arts education is found in its greatest development, is a noteworthy period of exploration in the child's life and, as such, offers an ideal time for experiences

provided by a well organized and competently taught program of orientation and participation. One state, a leader in industrial arts education, suggests six areas for such exploration and participation. These are the areas of woodwork, metalwork, printing, textiles, ceramics, and electricity. Other programs include work in transportation and in power. With such a rich program the pupils can make a comprehensive study of a number of industries and actually participate in laboratory experiences working with the tools and materials of these industries.

Provision for additional work on the senior high school level in industrial arts education permits more advanced work and a more searching study of industry and the problems of a technological society.

The methodology developed by industrial arts educators merits attention. Some programs feature the comprehensive general shop, a shop in which provision has been made for activities involving many areas of work. An especially broad comprehensive general shop might include as many as four, five, or even six areas selected from wood, metal, printing, textiles, ceramics, and electricity. Other programs, and these are more frequently found in the larger centers or schools, favor the unit general shop, a shop that provides for a wide range of activities in one area of work. Such a shop might be a general unit metal shop in which such aspects of metalwork as forging, foundry work, sheet metal work, art metal work, machine shop might be taught. In the case of the unit general shop, the pupils are usually rotated through a number of shops so that they may experience work in a number of areas.

The industrial arts shop of a modern school always includes a shop library of resource materials, a planning center, and the various working areas where the pupil is able to duplicate and actually reproduce actual industrial experiences. To the pupil, the industrial arts shop becomes an experimental laboratory in which he may test and compare, check and analyze, and create new and varied applications of the principles and practices of industry. He may make hand-made paper, bind a book, develop a ceramic glaze from the raw materials, develop a pattern for casting a power jig saw, design and construct a table or a chair, knit a cravat, develop a photolith process, or build a radio. The human relations aspect of industry also finds its reflection in the modern industrial arts shop. A pupil personnel system enables pupils to obtain valuable experiences in controlling their own activities. This system usually includes the designation of a general superintendent, a tool foreman, a librarian, and a foreman in charge of each work area. These assignments are rotated among the pupils so that each one may have his chance to assume responsibility, to exercise his bent for leadership, and to take directions from his fellows.

As a phase of general education in an industrial society, the program of industrial arts education has grown tremendously. In most school systems work in industrial arts is required of all children in the junior high school. Both boys and girls participate in the shop activities and these activities have expanded greatly. Industrial arts education has assumed an important place in the American schools.

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INDUSTRIAL BANKS. See BANKS AND FINANCE—21. *Installment Lending Institutions* (Industrial Banks); UNITED STATES—21. *Banking Systems* (Types of Banking Institutions).

INDUSTRIAL DESIGN. Industrial design is a profession comparatively new to our culture, allied with, and stemming from, mass production. It is, further, the profession which seeks the integration of industry with our culture—a merger which to date has not been entirely accomplished.

In previous periods we have found that the artist-craftsman utilized whatever technical innovations came his way and designed for them; but the Industrial Revolution was so overwhelming in scope that it has taken many decades for the machine to be recognized as the successor to handicraft and to realize its rightful position in our culture. Industrial design is the art of the machine, and as such is a completely different medium of expression from handicraft. Household objects, once the realm of the skilled artist-craftsman with resultant limited production and high cost, could, with the advent of the machine, be produced in vast quantities at low cost and, therefore, quickly reach a majority of the population.

Man has always had a tendency to style those articles he possesses, as his response to beauty is inherent and, given a choice, he will always select that which is beautiful. The industrial designer, then, is the artist in the service of industry. Essentially, he is a sculptor who combines his creative talent and knowledge of three-dimensional form with modern technology. His main concern is the appearance factor of those products made in mass by the machine. He relates his aesthetic values to the total problem of a factory-made object which includes consideration of function, materials, tools, manufacturing processes, and economy. He is keenly aware of the end product which rests on the sales counter or sales floor and finally in the home. His is the duty of successfully combining and relating three different points of view: the manufacturer's, the retailer's, and the consumer's. His main contribution is a contemporary art expression in everyday objects.

Evolution of the Designer in Industry.—In the early stages of mass production, the potentiality of power-driven machinery was not fully understood by manufacturers, whose first thought it was simply to increase production and consumption of the many household items once made by the costly hand method. It is not surprising, therefore, that the earliest machine products borrowed a great deal from their handicraft predecessors, thus producing a synthetic art, a veneer as it were, for the artisan-craftsman brought inspiration to his work and it reflected him and his age. Early examples of machine art in its own right are rare; for the most part manufacturers were content to imitate the past and accept the limitations of tradition, counting machine products merely as a substitute for handicraft. As an example of this, we still find the art forms of other cultures indiscriminately applied to present day objects. Chippendale, Sheraton, Duncan Phyfe,



Above left: Perfect balance, firm rubber grip, and stainless steel of modern hammer give pleasure and satisfaction in use. Above right: Compact Monroe adding machine styled for elegant efficiency in modern office environment. Right: Three-dimensional studies in modern geometric forms are conducted by faculty of new school of design at Ulm, West Germany.

INDUSTRIAL DESIGN



Above: Jaguar XK-E Gran Turismo coupé seats two in the luxury of its functional design, devoid of all that is superfluous.

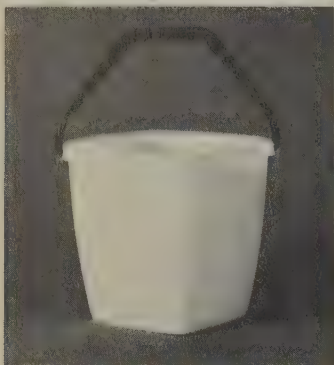
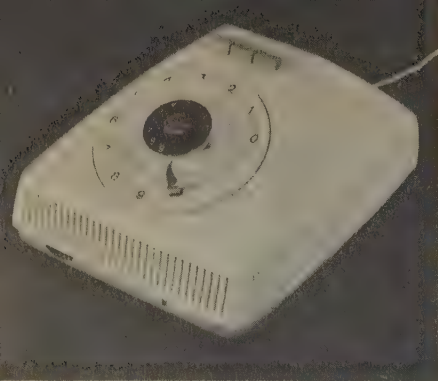
Right: General Motors styling staff work on mock-up of experimental Firebird III to increase stability by tail fin design.

(Top left) "True Temper" Corp.—Photography by SANDAK, Inc.; (top center) Monroe Calculating Machine Co.—SANDAK, Inc.; (top right) Thomas Hollyman from Photo Researchers; (center) Jaguar Cars, Inc.; (bottom left) Westinghouse Electric Co.—SANDAK, Inc.; (bottom center) Sitterle Ceramics—SANDAK, Inc.; (bottom right) General Motors Corp.



Below left: Housewives delight in lightness and sleek lines of this plastic-handled electric iron. Below right: White porcelain depends for visual appeal on functional purity of line.

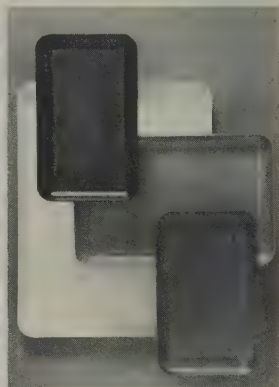




Above: This frequency modulation radio, designed to fit the average bookshelf, has a pair of 6-inch stereophonic speakers in detachable cabinet doors. Above left: A Swedish telephone with built-in microphone and loudspeaker to eliminate the hand phone. Left: A light-weight pail of linear polyethylene plastic designed to pour and stack easily.

(Top left and left) The American Swedish News Exchange; (top right) General Electric Co.

INDUSTRIAL DESIGN



The American Swedish News Exchange

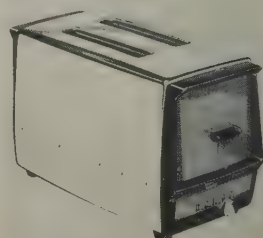
Above: Simple in design, these polystyrene plastic trays are light weight and stain resistant.



Above: Whatever the project, many artists' sketches are considered before an ultimate design is adopted.

Left: A washbowl cleverly designed to eliminate the messy soap-dish problem. Soap is kept below the rim (see mirror).

Right: A pop-up toaster styled to conform with contemporary furniture. The numbered dial permits accurate timing.



(Lower left center) Ford Motor Company; (bottom left) Crane Co; (bottom right) General Electric Co.

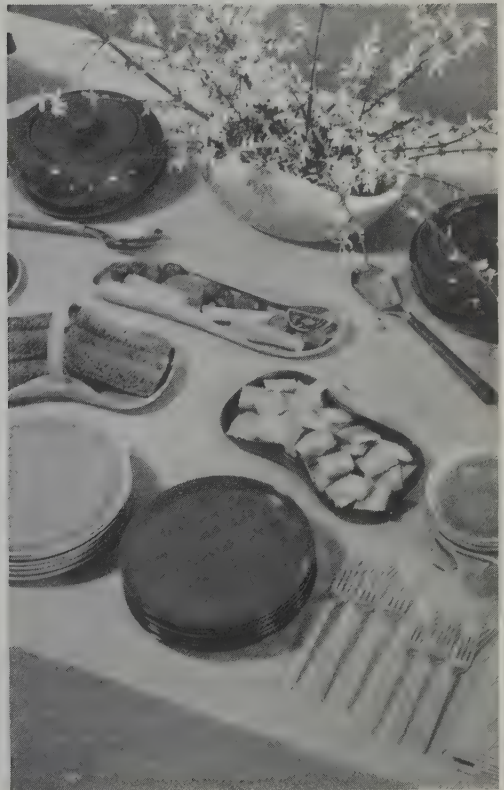


Courtesy du Pont Company

Viscose tanks in a modern "Cellophane" plant.

INDUSTRIAL DESIGN

Pottery dinnerware designed by Russel Wright, and made by Steubenville Pottery.



INDUSTRIAL DESIGN



Mass production design for liquid containers to be used in refrigerator.

Three-dimensional design in plaster on the moldmaker's jolly.



Adams, and Hepplewhite are historic names in household furnishings, but the machine inherently was not meant to imitate these styles, a practice which has existed for so long a time. The transition from applied design to functional design was slow, and in some areas has yet to occur.

More recently, the value of the power tool has come to be understood, but it is only in the past decade that the industrial designer has been recognized as a specialist in his own right. It is obvious that in an economy geared to production traditional styles cannot be copied to infinity. With the artist-craftsman almost extinct, the market became glutted with synthetic styles of the past with no new shapes to represent this new era.

As standardization implies both quantity production and broader distribution, the emphasis must be placed on the product rather than its method of manufacture. (The use and design of the automobile, for example, concern most of the people in the country, but the process of manufacture concerns only the planning unit and production crews in the factory.) All the thought and skill of the specialist must thus be directed to shaping a perfect, or near-perfect model suited for both mass production and mass acceptance. The lack of consumer acceptance soon became a problem with which the manufacturer had to cope. The earliest attempts to alleviate this state of affairs were characterized by an ugliness resulting from a lack of the artist's hand. Factory engineers and foremen took a step in the right direction when they cast off the applied design of alien traditions and began production of the unadorned shapes which are characteristic of the machine; but that solution which is usually satisfactory to an engineer or factory foreman may be extremely unpleasant to the buying public. The first machine designs were no more pleasing than the machine-produced handicraft designs. The situation demanded the talents of a person who could not only understand the technical aspects of producing an article, but also one able to relate the final appearance of the product to these technical aspects and to the psychology of mass acceptance as well—in short, what was needed was the industrial designer.

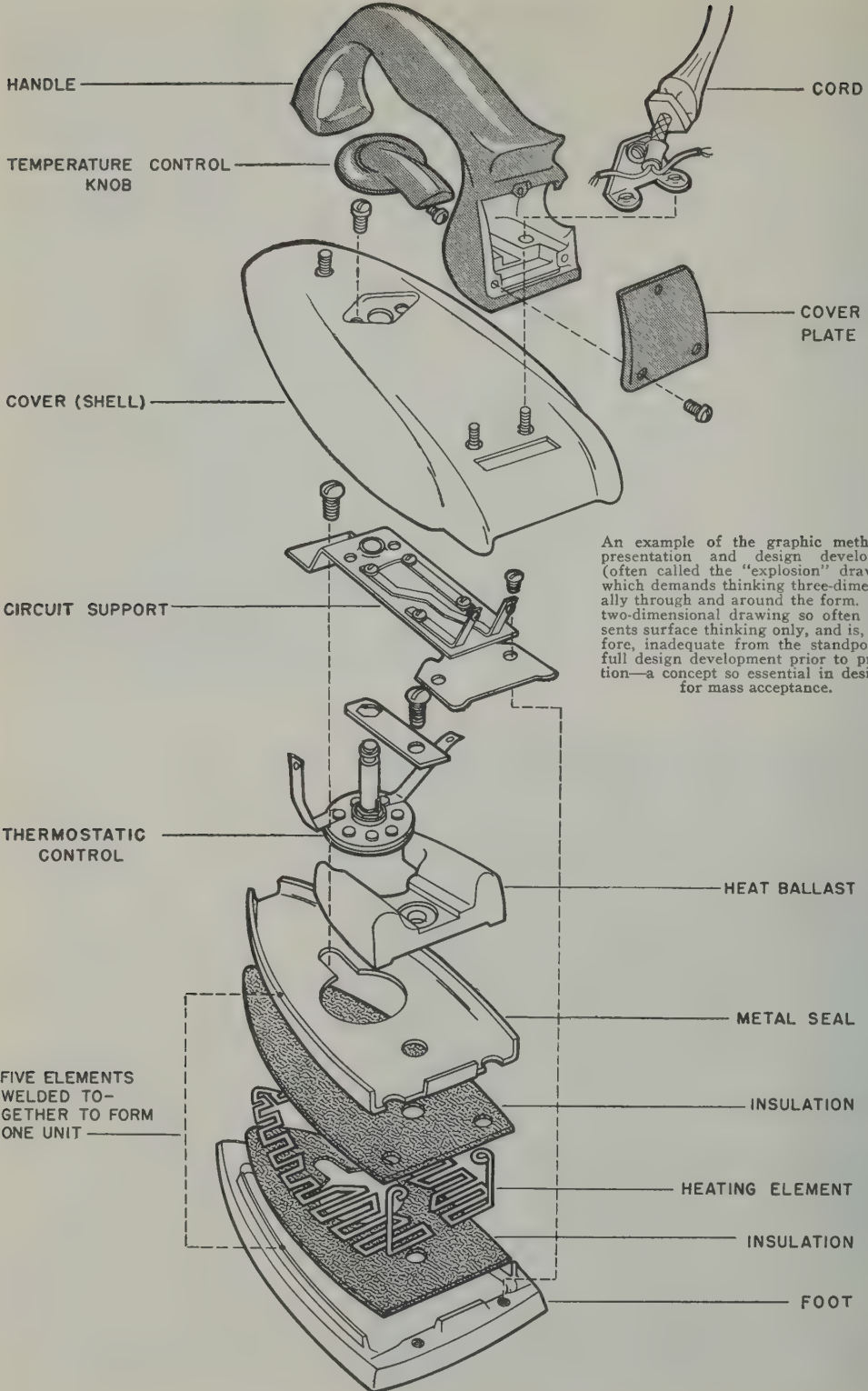
The first designers for industry were not industrial designers as such; rather, they were men of creative sensibility drawn from the allied fields of fine arts. These sensed the possibilities inherent in the machine at a time when the general population sensed only the ugliness of the whole factory system, from the slums it created to the bad replicas of hand-made objects. Theirs was a difficult task, with the level of good taste at its lowest in the history of the world. The harsh and unharmonious engineer-produced shape at the turn of the century was the basis of a reaction in the English arts and crafts movement which reached its height on the Continent under the leadership of such men as Josef Hoffman and Henry Clemens Van de Velde in a style now known as *art nouveau*, characterized by extreme curvilinear forms. *Art nouveau* (also known as *Jugendstil* or "Style 1900") was international in character and the first decorative movement to actually break with the trends of eclecticism. But it was not until the Bauhaus (1919-1929), the famous design school in Dessau, Germany, under the leadership of the architect Walter Gropius, that the art of the machine came of age. Many of the great names of modern fine arts are associated

with the Bauhaus, and here we find the machine age influencing the fine arts as well as the fine arts influencing the machine product. The Bauhaus movement was more and more in the direction of machinelike simplicity typified by Marcel Breuer's chair of tubular steel. The architect Charles Edouard Jeanneret, known as "Le Corbusier," defined the house as a "machine for living" and with Jacobus J. P. Oud of Holland and Mies van der Rohe built structures of precision simplicity and functionalism based on geometric shapes. The integration of industry and culture had begun. The experiments at the Bauhaus in designing with new materials and with problems in the interrelation of space gave rise to the constructivist movement in sculpture and thence to the application of these principles to the design of household articles as well.

The Art of the Machine.—The art of the machine is essentially devoid of surface ornament, and is characterized by precision, simplicity, and ease of duplication, in contrast to handicraft which is irregular, unique, and difficult to produce in quantity. The two are, as has already been pointed out, completely different mediums of expression. The ancient Roman architect, Marcus Vitruvius Pollio, stated that architecture should contain three elements: utility (or function), strength or vitality, and beauty. These qualities are still valid and could be applied to any of the arts serving man's needs—especially industrial design, the art of the machine. While a great deal of energy had in the past been expended in the advertising or visual presentation of the product to the consumer, it took a long time for manufacturers in general to recognize that art qualities need not be confined only to painting and sculpture but may be present in all of the products made by man.

The manufacturer came to realize that these qualities are universal, with universal appeal, and that they do not necessarily forego mechanical efficiency. The machine art experiments at the Bauhaus attracted the attention of the intelligent creative artist who saw in true machine forms not ugliness, indeed there was beauty in sheer surfaces and abstract shapes. It was only necessary to adapt these qualities in order to achieve a harmonious beauty in the finished product—to bring in delicate perceptions and a fine sense of subtle relationships of form, color, balance and unity, and to study these factors in relationship with the technological aspects of factory production.

Cultural Determinants in Design.—The world we live in today was shaped by the Industrial Revolution; our culture and economy are based on mass production. In contrast with the agrarian civilizations of the past, where nothing changed greatly from year to year, the pace of our life is quick indeed, and becomes the more so as technical advances continue at a rate unimaginable by our forebears. We are dependent on the machine and on the specialist, for with the power tools comes a division of work; an employee becomes a single link in a long chain of production, doing one step or part in an entire manufacturing process. The machine has brought us an increase in the standard of living. Today the many household articles that once might have been a luxury to be enjoyed by very few are within the reach of everyone. Indeed, they are no longer "luxuries," but are now considered "necessities," and the fact that they are so considered is further



An example of the graphic method of presentation and design development (often called the "explosion" drawing), which demands thinking three-dimensionally through and around the form. Mere two-dimensional drawing so often represents surface thinking only, and is, therefore, inadequate from the standpoint of full design development prior to production—a concept so essential in designing for mass acceptance.

proof of how far our culture has progressed. The work day is shorter, allowing more time for leisure and interests outside of earning a living. Vitality has improved and the importance of the human being has been strengthened. Evidences of man's ingenuity are all around us, being especially visible in the cities where natural forms are, for the most part, replaced by those which are man-made. The structures that house us and our activities and the multiple objects necessary for our daily existence are determined in form by their own purposes. There is a never-ending procession of new forms coming into being. Some replace worn out or obsolete items; others are entirely novel in appearance and utility with new needs served by new shapes. Control of new shapes then becomes the work of the engineer who solves the mechanical problems and the industrial designer who works with him to solve the functional and appearance problems. Unlike his predecessor, the artist-craftsman who thought in terms of one item made with simple tools, the industrial designer thinks in terms of large quantities produced by complex machines. His concern is not in achieving aesthetic appeal by a final rub-down coat of varnish on a breakfront, but to achieve a design containing aesthetic satisfaction while employing new techniques and materials and meeting new demands. Above all, the shapes he employs are not derivative. They belong to no period and have no traditional imprint. They are, instead, thought-out contemporary shapes, formed by need, science, and aesthetics, and are, moreover, true expressions of our civilization and culture—just as the shapes of the past are reflections of past cultures.

Function or Utility as First Concern of the Designer.—There is a purpose to all shape. Sculpture seeks to attain pure aesthetic quality at the highest and purest level. Common articles should contain beauty with function. The purpose of a statue is aesthetic but the teacup must hold a given amount of hot liquid to fulfill its purpose. The statue belongs on a pedestal; the cup belongs on a table. Both take their place in the expression of a culture. The function of the object is, therefore, the first concern of the designer. With the function begins the shape. Man is the designer's measure; man's environment at home, at work, at play, is of prime importance. Distances and proportions are based on the size and movement of the human frame and ideally should take into consideration psychological factors as well, for man is more than his physical size. The finest appearance in the world will hardly fulfill the requirements of a chair if it is incapable of containing a person comfortably and securely. Close observation of normal human activities is essential to the industrial designer who might be thought of as a "human engineer."

Strength or Vitality as Factors in a Design.—Vitruvius's quality of strength or vitality can probably best be defined as honesty—truthfulness to the age in which the design is produced and to the materials and manufacturing processes involved in its making. We have already noted that early machine-made items lacked this quality, being derivative or eclectic designs rather than true creative forms. The Gothic cathedral was an honest expression of its time, but it cannot be said that the Louis XV legs on the gas stoves of only a few years ago were expressive of our way of living. In the same way, the materials of which the product is made should be expressed with

honesty as they have an integrity of their own, and in the hands of a competent designer can fully express their individual beauty. While the simulation of one material by another may be an interesting technical feat, it is most surely bad economic practice and worse design. We are all familiar with the feelings of distaste attendant to the "cheap" or copied. Metal, being metal, should be handled as such. Attempts to give steel the appearance of wood neither fully succeed in doing so nor properly utilize the possibilities of the material. The designer will familiarize himself with the inherent qualities of many materials and will, consequently, be able to design with equal ease for any given one.

The tools and processes required in the production of any article will have their effect on the nature of the design and leave their imprint and character in the material. The design should also honestly represent its means of manufacture. The hand-carved motifs on much of the furniture of the past cannot honestly be duplicated by machine since the great value of these pieces lies in their slight irregularity and in the loving care lavished on them by skilled hands over a long period of time.

The economic factor in the production of the design will require the artist's full utilization of his ingenuity in handling well his materials and processes, for while it may be possible to produce by machine anything at all that a designer might conjure up, it is hardly feasible to do so unless it will find acceptance with the buyers. The cost of manufacture of any item and its intended market will be one of the major determinants of its character.

Beauty or Fine Appearance in a Design.—Beauty or fine appearance is one of the most elusive factors involved in designing and is, of course, closest to the designer's interest. While there is no satisfactory universal definition of beauty, the design will incorporate elements everyone will agree are related to beauty; timeliness; vitality and honesty of expression; subtle harmonious relationships between colors, textures, areas of thickness and thinness; and balance of all the forces in the design—all elements which might be called good taste. It should be emphasized that the fundamental requirement for the designing of beautiful objects is not enthusiasm or persistence, although both are necessary, but talent.

An example of recent industrial designing that will probably remain a classic is the series of chairs by Charles Eames. These chairs possess all the qualities that have been mentioned and represent true creative designing for the machine age. They have been designed for the human figure in the seated position and are light enough to move about easily; they employ the latest materials and manufacturing processes; they are fine functional shapes entirely suited to our way of living with no excess ornament. The shape itself, rising from its function, is aesthetically pleasing and needs nothing applied.

The Training of the Designer.—With the recognition of the need for specialists in the art of the machine, art schools began to set up courses to meet this need. College degrees were first offered in the field of industrial design in 1936 and there are now a number of excellent courses in schools throughout the country with industry participating in some cases by offering scholarships. In addition, some liberal arts schools



DEVELOPMENTS IN CHAIR DESIGNING INFLUENCED BY THE MACHINE AGE.

(A) The Thonet chair of bentwood is a lightweight, rigid structure weighing considerably less and having fewer parts than a conventional wooden chair. (B) The Breuer chair is an early example of economy in design using tubular steel. (C) This Alvar Aalto chair is an early example of lightweight laminated plywood. (D) The Eero Saarinen chair is made of formed plastic with foam rubber. (E) The "bucket seat" chair by Eames is molded of fiberglass-reinforced polyester plastic. (F) The "Barcelona" chair of Mies van der Rohe is a functional, aesthetic expression in steel, foam rubber, and calfskin.

offer descriptive courses in or relating to industrial design. Most courses in industrial design are four-year programs. Successful completion of such a course is gradually coming to be a prerequisite for employment as more and more the trained designer is being consulted in the case of many inexpensive items as well as high-priced articles (which represents a tremendous achievement in so young a profession). A well balanced program will include the liberal arts, technical subjects, and, most important, thorough design training and aesthetics.

The liberal arts subjects will give the prospective designer the broad academic background necessary for successful living in the world of

today with an appreciation of his place in history as well as an appreciation of the achievements of the past. The technical subjects will enable him to appreciate new materials and techniques—all problems of the engineer with whom he will later work closely. His art or design training will produce creative thinking as a result of consideration of these other areas.

Three-dimensional design is the most important area of aesthetic training for the prospective designer. His first experiments in three dimensions will be in sculpture where he will relate tectonic shapes and plastic forms to abstract designs. Tectonic implies building or construction, therefore, tectonic shapes would be fabri-

cations where thin sections or planes are arranged into an agreeable pattern which moves in space to the maximum degree. This same principle is the basis of architecture and is called architectonic when applied to that field. Tectonic form study would begin with constructions in abstract sculpture and terminate with experimental design problems in subdivisions of architectural enclosures in terms of interiors, furniture, and furnishings. Plastic form is not fabricated or built in sections but always appears as an integral unit as if poured from a mold. It is the development of convexities and concavities and consists of modeled surfaces where all planes flow into each other, rather than the juxtaposition of planes as in tectonic forms. Plastic form in the sculpture of convex or concave figures or abstract shapes would lead into designing the plastic forms of many everyday objects, from an automobile to a handle.

While two-dimensional design is an important facet in the training of the industrial designer, it should be stressed that the development of good graphic technique alone will not make an industrial designer who will always be dealing with three-dimensional problems. Empathic sketching (literally, a feeling into the design of the emotional stimuli from the problem object), a course in the art of brevity in graphic expression, will enable the designer to record his ideas rapidly preliminary to studying the dimensional aspects of the shape, but these ideas on paper are a very different thing from the three-dimensional realization of the form. Even a very simple, easily comprehended shape, such as the cylinder, can be deceiving in its appearance on paper which is usually different from its appearance in the round. So many industrial products have been unsuccessful for this very reason—they began and ended on the drawing board. For the most part, two-dimensional representation will be used as a means of presenting the form after it has thoroughly crystallized in three dimensions and a series of models made. Hence two-dimensional design is the medium particularly suited to the advertising or illustration of a designed form.

The training will also include model making, use of power tools, mold making, and photography. In some cases, where equipment permits, a complete factory problem will be simulated. Experimental design familiarizes the student with materials, structures, and production methods, and is usually taught with the assistance of advisors from industry.

The field continues to expand with the expanding economy and also with the growing aesthetic consciousness of a good portion of the public. Design studios are now essential departments in every major manufacturing enterprise, and a good number of smaller ones have design staffs or hire free-lance designers. Styling sections can run into several hundred persons and include engineers and technicians along with the designers. These will usually have a definite program for apprenticeship with special and advanced training in the particular problems of the company, procedures of the studio, nature of the articles to be designed, factory set-up, and types of market.

After graduation from a recognized school the designer's orientation is usually short and he becomes a permanent member of the staff in only several months. In a studio or small group, the newcomer is assigned to an experienced

designer for a short period. Later he works as an associate or is given an assignment of his own.

There are two national organizations: the Industrial Design Institute (IDI), and the Society of Industrial Designers (SID). Both have regional and city chapters throughout the country. A code of ethics to protect both manufacturer and designer has been devised as industrial design seeks to ally itself with the group of professions which maintain recognized standards and whose practitioners meet fixed standards.

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INDUSTRIAL EDUCATION. The belief that training for work is not only a necessity but a valuable ingredient in acquiring a complete education has long existed. The generic term used to cover that aspect of education whose controlling purpose is gainful employment is vocational education (q.v.). Industrial education is that part of vocational education which prepares people for occupational efficiency and adjustment in one of the many callings in the areas of industry and trade. Vocational education is concerned with the development of the individual both as a person and as a worker; it is that phase of an individual's complete education for functional citizenship that prepares him for maximal occupational adjustment and gainful employment. Industrial education is characterized by its central purpose of providing experiences whereby an individual learns successfully to engage in an industrial occupation, to appreciate and understand the common cultural heritage, and to participate effectively in civic affairs. In a very strict sense the term should be vocational-industrial education and should be classified along with such branches of vocational education as vocational-agricultural education, vocational-technical education, vocational-business education, and vocational home economics education. Industrial education is not to be confused with industrial arts education. This last term may be defined as that part of the general education of all citizens in an industrial society and is the study of the changes made by man in the forms of materials to increase their values, and of the problems of life related to these changes (see **INDUSTRIAL ARTS EDUCATION**).

Education for industrial pursuits is as old as civilization itself. In primitive societies at the dawn of history, the members of the community were inducted into the occupations necessary to sustain the life of the tribe and they were trained for these occupations. In the complex and highly technical economy of present-day industrial societies, individuals must learn to participate effectively in some area of the work to provide the food, clothing, shelter, and services necessary to maintain and to advance standards of living.

Industrial education serves many groups in 20th century societies. The pre-employed group seeking initial entrance into the world of industrial work may be served in the all-day school. Such full-time schools are known by a number of names. Among those in common use are vocational schools, industrial high schools, and trade schools. Young workers who are in occupations that for one reason or another they do not wish to make their life work are served by part-time or evening programs of industrial education.

Those who are already at work in industry and who wish to prepare themselves for wider service or more advanced jobs may be provided with programs of in-service or up-grading industrial education. In the highly skilled trades, a modified form of apprenticeship serves as the program of industrial education. Workers in declining industries and the unemployed may be retrained for new industrial jobs in programs of industrial education especially designed to meet their needs. Increasing attention is now being given to programs of industrial education designed to rehabilitate those handicapped through injury or disease whether acquired or existing since birth. These last programs seek to prepare these people for entry or re-entry into the world of productive employment.

The wide range of services that industrial education may render to the community implies the existence of numerous agencies to carry on such diversified activities. Some of these agencies are private; some are public. Many of the programs are provided by the schools while others are given under the aegis of industry itself.

Industrial education of less-than-college grade and under public auspices is federally aided in the United States. Under the terms of the Smith-Hughes Act (the National Vocational Act of 1917) federal funds as grants in aid are available, under certain conditions, to provide for cooperation with the several states in promotion of industrial education. The George-Barden Act of 1946 provides for the further development of certain types of vocational education, including industrial education, in the several states and territories and amends and extends the provisions of the Smith-Hughes Act. Additional amounts of money, too, may be appropriated under this second federal law.

From the early stress on manual skills and related technical knowledge that characterized the programs of industrial education for the pre-employed group in the first four decades of the 20th century, trends may be identified which indicate a change in philosophy and in practices. New York City, for example, sees the vocational high school as an agency to provide a well-rounded, fully balanced program of secondary education. This great industrial metropolis is concerned that the pupil be educated for life as well as for a livelihood. The industrial high school pupil, it is pointed out, is no different from any other adolescent in his need for character and personality training; for the development of correct habits, attitudes, ideals, and standards of conduct; for the acquisition of the virtues of loyalty, diligence, honesty, truthfulness, kindness, courtesy, and respect for authority. The aims of industrial high schools may be stated as follows: *Character*—to insure the basis for rich, useful, ethical living in a society promoting the common welfare; *Our American Heritage*—to develop pride and faith in American democracy, including respect for the dignity and worth of individuals and people, regardless of race, religion, nationality or socio-economic status; *Social Relationships*—to develop desirable social attitudes and relationships within the family, the school, and the community; *Economic Relationships*—to create an awareness of economic forces and an understanding of their impact on all who serve in the world of work; *Thinking*—to develop reasoning based on adequate hypotheses, supported by facts and principles; *Skills and Knowledges (Academic)*—

to insure a command, in accordance with ability, of the common integrating knowledges and skills; *Appreciation and Expression*—to promote the appreciation and enjoyment of the aesthetic and cultural aspects of living, and to foster powers of creative expression; *Health*—to develop and maintain body and mind in sound, wholesome condition; *Exploration and Guidance*—to discover and direct desirable individual interests, aptitudes, and abilities and on this foundation to encourage a wise choice of educational, vocational and social goals; *Occupational Competency*—to establish useful occupational knowledge and skills, assisting each individual to reach his highest level of accomplishment; and *Vocational Adjustment*—to enable satisfactory adjustment in vocation. Toward pupil attainment of these social, personal, and vocational competencies, the industrial high school curriculum should include: (1) participation in democratic citizenship, (2) cultivation of capacities for the fullest enjoyment of life, and (3) education for work.

Industrial high schools designed to prepare adolescents for initial industrial employment are of several sorts. The general industrial high school provides programs in a number of trades. Such a school might offer programs for boys in automotive repair and service, cabinet-making, carpentry, commercial art, commercial photography, electrical construction and maintenance, food service, machine shop, masonry, sheet metal, and tool and die making. For girls, such an industrial high school might have beauty culture, trade dressmaking, food service, business machines, commercial art, and fashion illustration.

In the larger cities there may be central industrial high schools which provide training for the numerous areas of an industry or trade. A food trades industrial high school might offer programs in baking, butchering, cafeteria work, and retail grocery store work. A needle trades industrial high school might have in its curriculum courses in apparel manufacturing, pattern making and design, fashion design, pattern draping and design, power machine operation, millinery, trade dressmaking, shoe and leather goods manufacturing, and fur garment manufacturing. In order to extend the services of industrial education and provide such training for more and more individuals, the schools have developed a structure called the area vocational school. This is a school that serves a large geographic area such as a number of cities, a county, or a section of a state. Communities too small to support a vocational school may enter into a contractual agreement and join together to provide a centrally located vocation school developed to serve the needs of the wider area. Another adjustment designed to meet the needs of those seeking industrial training is the cooperative industrial program. An industrial cooperative program is one that provides industrial training by sharing the services available in the school and utilizing the shops of local industrial establishments. In an industrial cooperative program a student spends part of his time in the school and part of his time working in an industrial plant. The arrangement of time may be on a half-day basis, or a week-to-week basis. All of the time, however, the pupil is under the supervision of the school and the supervising agent is called a teacher-coordinator. It is the task of this school person to integrate the work of the shop with the work of the school in the case of each cooperative student. This program permits the

very real experiences of industry to be coordinated with the learning process. It also permits a student to earn while learning because while in the industrial shop the student is on the payroll of the employer.

Industrial education has closely followed the development of industry in the United States. With the rise of manufacturing to a place of paramount importance following the Civil War and with the growth of the service trades during the first half of the 20th century, industrial education has been extended throughout the country and the programs have been enriched and widened. Federal grants in aid, too, have acted as stimuli to the development of the programs under public auspices.

Following the pattern outlined in the Smith-Hughes Act, the school day for the pre-employed group is divided into three parts; at least half of the time is given over to useful or productive work in the shops while the remainder of the time is devoted to studies related to the trade and to general social and civic education. Another pattern which has developed from the traditions that surrounded industrial education and which has been fortified by the acts that provide federal aid is the separate industrial school. In many cities there is a division between the industrial or vocational high schools and the academic high schools. The programs are in different school buildings and supervised and administered by different personnel. Educators are currently questioning this practice and they point to the fact that each individual is entitled to both general and specialized education. The all-purpose or comprehensive high school has been developed to bridge the gap between the academic high school and the industrial high school. The comprehensive high school which has appeared in many communities offers both academic work and vocational work.

Although stress has been laid upon industrial education for the pre-employed group, by far the greater number of individuals pursuing industrial education are enrolled in part-time courses that follow the day's work. In evening programs of the public schools, in the day and evening sessions of the private trade schools, in factory schools, in foremanship training classes, in numerous on-the-job training programs, in schools conducted by labor organizations, in apprentice training programs, and in vocational rehabilitation centers are thousands of individuals seeking to become occupationally efficient in the skills and habits necessary for industrial employment.

Industrial education in the United States has reacted to the pressing emergencies in the nation's history. The Smith-Hughes Act was passed in February 1917 and came just at the time when skilled workers were needed for the war-supporting industries and when sources of skilled workers from Europe could no longer furnish such a work force. In the years of the great depression, following 1932, numerous federal agencies sought to provide industrial training for those out of regular employment and for those youth who could find no employment. Following Pearl Harbor, the federal government took the leadership in the training of workers for the war industries. Through federal subsidies and in cooperation with the several states thousands of workers were trained in the skills vital to industrial production in a war-time economy. At the termination of hostilities, many veterans took advantage of the educational provisions of the various servicemen's

acts and enrolled in full-time and part-time courses in industrial education.

The development of a program of industrial education to meet the needs of a community is a problem for cooperative effort. The needs of individuals must be identified and met and likewise the absorbing capacity of the industries must be estimated. Several groups in the community are vitally concerned, namely the youth (and their parents), management, labor, and educators. In many communities provision is made for industrial education advisory committees charged with the responsibility of developing policies and plans for programs of trade education. These advisory committees are usually composed of representatives of management, labor, education, and the general public. In many states advisory committees are authorized by law and required to be set up. Advisory committees have in many cases proved remarkably effective in promoting sound programs of industrial education.

Looking back over the long history of industrial education, certain landmarks stand out. Throughout the Middle Ages, the apprenticeship system provided the general and industrial education for those who sought their livelihood in the secular trades. Apprenticeship as a form of industrial education persisted down through the years to the advent of the factory system and the age of power-driven machinery. It is still functioning today in certain skilled trades. With the coming of the factory system and the evolution of modern industry, the apprenticeship system of the middle centuries was no longer appropriate as a universal method of providing workers for the skilled, semiskilled, and unskilled vocations. New programs of industrial education had to be devised and the schools were looked to to supply these. Again, following the devastating wars of Reformation and post-Reformation eras, humanitarian leaders sought to care for the homeless war orphans. Others sought to provide a functional education for those in penal institutions. Both groups saw in industrial education a way to provide for the reclamation of these unfortunates. In the years of the first Napoleon, France established great military and technical schools that served as models later for other European and American schools. With the rise of the German Empire after 1870 and with the rapid industrialization of the new united Germany, that nation developed important technical schools and continuation schools designed to provide workers with the skills necessary in the occupations of a highly technological society. In England, the workingmen's colleges and the mechanics' institutes of the United States are parallel manifestations of the interest in the further education of industrial workers.

As the United States enters into the second half of the 20th century it is reasonable to assume that continued strides will be made in technology. New materials, new machines, new powers, and new methods will undoubtedly characterize American industry. It is to be expected that industrial education in the future will reconstruct itself in order to provide the educated labor force competent to assure the further development of the American experiment in industrial democracy.

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INDUSTRIAL ENGINEERING, a science which has as its basic objective the provision of conditions which will permit the accomplishment of a given task in the least possible time, at the lowest total cost, with the least effort, and with the most satisfaction to the people who must do the work. It is the engineering approach applied to all factors including the human factor involved in the production and distribution of products or services.

Industrial engineering derives its name from the fact that it was first used by industry. Its initial use was largely confined to the factory. Although this continues to be its principal area of application, the industrial engineering approach was later found to be equally valuable in the office and in nonindustrial enterprises such as hospitals, hotels, libraries, and even in agriculture and in the home.

Because almost every activity of a business has its effect on the ultimate cost of the goods or services it produces, it is often difficult to make a clear distinction between industrial engineering and scientific management. In the period which immediately followed the development of scientific management by Fredrick W. Taylor at the beginning of the 20th century, industrial engineering in the language of the factory was considered to be nearly synonymous with time and motion study. With the passing of time, however, the industrial engineer found it desirable to include a consideration of more and more factors in his studies. His interest in quality, for example, led him into the field of quality control. Similarly he came to include among his specific interests such techniques, systems, and procedures as production control, budgets, standard costs, tool design, methods engineering, wage incentives, job evaluation, office procedures, and a host of others. As a background for his activities, he drew upon mechanical engineering, economics, sociology, psychology, philosophy, accountancy, and the like, welding the phases of these sciences which affected his activities into a new science.

It is quite difficult to differentiate between industrial engineering and management engineering. In popular usage, management engineering is considered to be a somewhat broader term including fields such as organization and administration which are not usually felt to be part of industrial engineering. The distinction is not clear cut, however, and the industrial engineer as he grows and broadens his experience is likely to find that he tends to call himself with increasing frequency a management engineer.

In 1943, the Work Standardization Committee of the Management Division of the American Society of Mechanical Engineers began a project of developing definitions for all terms used in the field of industrial engineering. In an attempt to define the limits of this field, the committee prepared the chart shown in slightly altered form by Fig. 1. This chart shows a number of the techniques and procedures which together make

up industrial engineering. It will serve as a guide in the discussion which follows. The chart, however, by no means includes all of the techniques which are considered by one or more authorities as legitimately belonging to industrial engineering. Among the techniques and procedures which with some logic could be added to the chart are: production planning and control, inventory control, quality control, top management controls, plant location and construction, production line techniques, product design, office layout, storekeeping procedures, safety engineering, operator training, suggestion systems, and operations research. Even this list does not include everything in which the industrial engineer is interested.

Although the discussion which follows will confine itself largely to the areas shown on the chart, Fig. 1, which may be regarded as the hard core of industrial engineering, the essential broadness of the industrial engineering approach should be recognized. The history of the development of industrial engineering is one of constant growth and broadening. This is illustrated by the fact that in 1920, industrial engineering was taught in very few universities and then usually as a few unrelated elective courses tacked onto a mechanical engineering course. By 1950, 4-year university courses leading to the degree of Industrial Engineering, or B.S. in Industrial Engineering, were by no means uncommon.

Development of Industrial Engineering.—Fredrick W. Taylor, who is often referred to as the father of scientific management, also laid the foundations for much of what later came to be called industrial engineering. In 1882, Taylor was made the foreman of the machine shop of the Midvale Steel Company near Philadelphia, Pa. He soon recognized that the men whom he supervised were producing only a fraction of what they could produce. Since Taylor was responsible for the efficient operation of his department, this disturbed him, and he began to search for ways of increasing the productivity of his people. At length, he developed a procedure which he described at a meeting of the American Society of Mechanical Engineers in 1903 in a classic paper entitled "Shop Management."

Among other things, Taylor developed a system of time study and finally a formula for getting maximum production. His formula was: *The greatest production results when each worker is given a definite task to be performed in a definite time and in a definite manner.* Modern industrial engineering is based upon this formula, and although the procedures for accomplishing it have been increasingly expanded, developed, and refined with each passing year, the formula is still as fundamental for high productivity as it was when Taylor first advanced it.

In Taylor's time, the *definite task* was specified after a study of the job had determined the best operation sequence. The *definite time* was established by stop watch time study or from standard time data based on time study. The *definite manner*—that is, the method—was developed by painstaking experimentation and was recorded for the information of the worker and his foreman on an instruction card.

Taylor, stimulated in part at least by the work of Frank B. and Lillian M. Gilbreth in the field of motion study, recognized the importance of method. His accounts of pig iron handling, metal cutting, and the like are classic examples of early

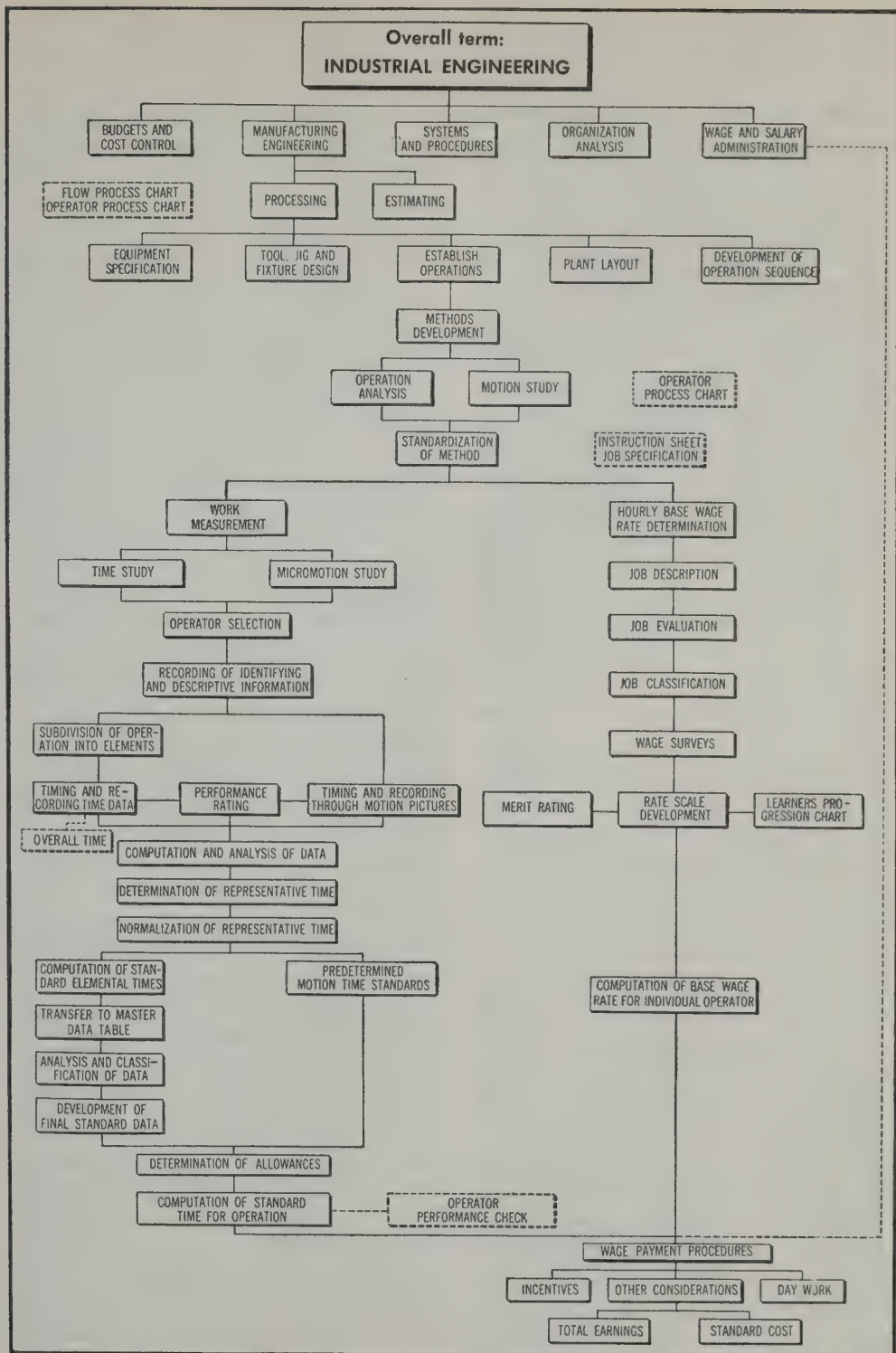


Fig. 1. Chart of techniques and procedures commonly included in industrial engineering.

methods studies. The results obtained by stop watch time study and the application of wage incentives in the form of increased production were so spectacular, however, that many of those who subsequently attempted to apply Taylor's techniques lost sight of the factor of method altogether. Their procedure was to time study a job, accepting without question the method being used by the worker, establish a production standard, and then apply it under a wage incentive plan. Large production increases were obtained, costs were reduced, and the work paid off handsomely.

Difficulties developed, however, when production increased considerably more than was expected. Because the method had received scant consideration prior to the application of incentives, many possibilities for improving it existed. When the operator was told that the more he produced the more he would earn, he began to study methods in earnest. In some cases, he found that major improvements could be made. His production—and his earnings—increased far beyond what had been anticipated.

Many managers of that period had the feeling that a given worker was worth only so much. They were willing to see a nominal bonus earned in exchange for a considerable increase in production. But when earnings rose above what they thought was an acceptable maximum, they became actively disturbed. Usually they took action to revise the standard or piece rate, either as the result of an out-and-out rate cut or as the result of a management-made methods change. In either case, the earnings of the worker were reduced, and it did not take him long to realize that it was not safe to earn more than a certain amount. As a result, a ceiling on earnings was tacitly agreed to by the workers, a ceiling which was seldom exceeded thereafter.

This developed into what was apparently a very satisfactory situation during the 1920's. Earnings under piece work or wage incentive plans were quite consistent—because they were pegged by the workers. Standards established by time study appeared accurate, because they produced anticipated earnings. The operators in most cases put in a reasonably full day's work, because the incentive to improve methods beyond a point which permitted the agreed-to top earnings was lacking.

Then came the growth of unionism in the 1930's. With the protection afforded by the unions and union contracts, workers became less fearful of breaking through earnings ceilings. When they found that the union could successfully oppose unjustified changes in standards, earnings began to rise rapidly. Latent methods improvements were put into effect, and earnings went still higher. Some jobs were more susceptible to improvement than others. As a result, inconsistencies in earnings among workers developed which created serious industrial relations problems. As this situation unfolded, the importance of establishing effective working methods prior to time study became apparent. It brought about a management change from an almost complete neglect of methods study, to a more and more detailed consideration of the factor of method.

Contribution of Motion Study.—The tools for the more intensive study of methods were at hand as the result of the pioneer work which had been done by Frank B. and Lillian M. Gilbreth in the field of motion study. In 1885 at the

age of 17, Frank Gilbreth started work as a bricklayer apprentice. On his first day at work, he observed that the skilled bricklayer who was acting as his teacher performed the work in three different ways. He used one set of motions when he was working slowly, another set when working rapidly, and still a third set when demonstrating to his pupil. When Gilbreth asked questions to try to find out the reasons for this, the foreman, thinking that teacher and pupil were wasting too much time in unnecessary conversation, transferred Gilbreth to another instructor. Here again Gilbreth observed the fact that his teacher used three different sets of motions and further that these were different from the three sets used by his first mentor.

Gilbreth's interest in this discovery became the basis for a major contribution to industrial engineering. Some years later, with the encouragement of his wife, Lillian M. Gilbreth, he decided to give up a profitable contracting and construction business and devote himself to the installation of scientific management, and especially to research and application work in the field of motion study. The Gilbreths began making detailed laboratory studies of motions and methods and at length developed a technique known as micromotion study.

As the result of analyzing motion picture films of a large number of industrial operations, the Gilbreths concluded that all manual work is performed by using a relatively few basic elements of work in varying combinations and sequence. They called these elements "therbligs"—the name "Gilbreth" spelled backwards with the "t" and "h" reversed. There were 17 therbligs in the original list known as: search; find; select; transport empty; transport loaded; grasp; release; position; pre position; assemble; disassemble; use; inspect; unavoidable delay; avoidable delay; rest to overcome fatigue; and plan. The micromotion study technique consists of analyzing a method into the therbligs used to perform it, making improvements which will eliminate, combine, or shorten the time for performing as many therbligs as possible, and developing as a result a quicker and easier method of doing the task.

Although the micromotion study technique is entirely practical, the laboratory aspects of the work and the use of unusual terms and symbols prevented many people from recognizing the value of the procedure as quickly as they should. Both Taylor and Gilbreth won many followers in the fields in which they pioneered. Some of these followers professed to see fundamental differences in the procedures developed by these two men, and at length two groups of practitioners evolved. One was the time-study group, and the other was the motion-study group. From roughly 1910 to 1930, these groups considered themselves as opposed to one another. The time-study group could see nothing practical in the laboratory approach, and the motion-study group felt that the time-study group were unscientific and crude in their procedures.

As time passed, however, both groups began to become better acquainted with one another's work, and as is so often the case during the development stage of a new profession, began to realize that they had been calling the same things by different names. The differences were dropped, and the best features of both procedures were combined into an integrated procedure, which the

author of this article and his associates in 1933 called for the first time as far as they know by the name "methods engineering."

The definition of methods engineering which they developed to explain this new term illustrates how the techniques which are the core of industrial engineering were beginning to form a logical pattern. According to this definition, "methods engineering is the technique that subjects each operation of a given piece of work to close analysis in order to eliminate every unnecessary operation and in order to approach the quickest and best method of performing each necessary operation; it includes the standardization of equipment, methods, and working conditions; it trains the operator to follow the standard method; when all this has been done, and not before, it determines by accurate measurement the number of standard hours in which an operator working with standard performance can do the job; finally it usually, although not necessarily, devises a plan for compensating labor which encourages the operator to attain or to surpass standard performance."

Major interest in methods improvement work began to develop in 1930. The United States of America was headed for the depths of the worst depression in its history. Business was almost at a standstill. A buyer's market existed, and competition was strictly on a price basis. Anything which would result in cost reductions was eagerly sought. Hence management was in a receptive mood for techniques which would improve methods. At this same time, the more advanced time study technicians were becoming aware of the incompleteness of their procedures as was pointed out above. Thus the time was ripe for the acceptance of methods study techniques.

In 1932, a book *Common Sense Applied to Motion and Time Study* by Allen H. Mogensen was published. This combined several articles by various men interested in methods study work with some of Mogensen's own experiences in what he presently began to call "work simplification" and gave one of the first coordinated presentations of the methods study practices which had been developed up to that point. Following this came an increasing number of other books, all stressing the importance of methods study. Among the more widely distributed books of this period were *Time and Motion Study and Formulas for Wage Incentives*, by Lowry, Maynard, and Stegemerten, 2d edition 1932, 3d edition 1940; *Motion and Time Study* by Ralph M. Barnes, 1937, 2d edition 1940; *Time Study for Cost Control* by Phil Carroll, Jr., 1938; *Applied Time and Motion Study* by Walter G. Holmes, 1938; and *Operation Analysis* by Maynard and Stegemerten, 1939.

The development of techniques of application of methods engineering and work simplification principles progressed rapidly from 1930 on. At the beginning of this period, the value of process charts, the questioning attitude, micromotion study, and the like as tools of methods improvement were fairly well recognized, but their application during a given methods study was likely to be unsystematic. Too many technicians tended to conduct their studies by concentrating on the correction of obvious inefficiencies, frequently overlooking greater possibilities for improvement. In effect, they often established efficient methods for doing unnecessary work.

Recognition of this caused the leaders in the

field to develop a more systematic approach in the application of methods improvement techniques. The "operation analysis" procedure organized upon the principle of considering first things first was one example of this. It emphasized that there are nine major points or factors which should be considered for every operation studied. These, arranged in logical sequence, are as follows:

- (1) Purpose of operation
- (2) Relation of operation to other operations performed on the part
- (3) Inspection requirements
- (4) Material
- (5) Material handling
- (6) Workplace layout and tool equipment
- (7) Common possibilities for methods improvement
- (8) Working conditions
- (9) Method

The "questioning attitude" tool—that is, deliberately asking why, where, when, what, who, and how about every detail of an operation—a tool used since the time of Taylor and Gilbreth, was expanded to include lists of practical questions to be applied to every step of operation analysis and even to every therblig.

These and similar developments helped to increase the effectiveness of methods improvement activities. The guiding principle of the industrial engineer became "with sufficient study, any method can be improved." Experience showed that this was literally true. The improvements were not always economically justified, but they were possible. Even after a job had been motion studied and improved, it often was possible to improve it still further as the result of more intensive study during which the problem was tackled afresh. A series of improvements could be made until the economics of the situation made further study unprofitable.

Methods improvement activities of this type resulted in many worthwhile economies and contributed importantly to increasing productivity wherever they were applied. They also introduced the problem of technological change and created tensions between management and the workers. The term "methods improvement" implies that an ineffective method is already in existence at the time the study is begun. The industrial engineer studies it, identifies unnecessary or ineffective motions, and by eliminating them improves the method. In effect, he corrects the mistakes which were made when the method was originally developed. His work is methods correction rather than methods engineering. Recognition of this fact led to the next important development in industrial engineering.

Predetermined Motion Time Standards.—It was repeatedly observed that human nature is such that it resists change. Thus when the industrial engineer sought to improve methods by changing old methods into better new methods, he frequently caused resistance or at least resentment on the part of the worker. His work which resulted in increased standards of living for society as a whole and hence was thoroughly desirable at the same time generated human relations problems which it would be better to avoid if possible. They could be avoided, however, only if methods were studied and improved before a job was put into production instead of after.

To do this, it became necessary to develop a somewhat different technique than time and motion study. What the industrial engineer needed, if he was to develop an effective method for

doing a job before production started, was a procedure which would tell him how long it would take to perform any motion sequence he might be able to visualize without having first to train an operator to follow it and then to time it with a stop watch. The use of predetermined motion time standards proved to be the solution to this problem.

The idea of predetermined motion time standards had been attractive to industrial engineers from the very beginning. Taylor visualized a handbook in which the time for performing "every element in every trade" would be listed. Gilbreth spoke of a "range of time" in which each therblig could be performed.

The first practical attempt to develop predetermined motion time standards was made by A. B. Segur, a consulting engineer, prior to 1930. The results of his researches, however, were made available only to his clients so that his system of "motion time analysis" was imperfectly understood by the industrial engineering profession and its applications were limited. At the same time, the procedure when applied by properly trained engineers met with considerable success and helped to focus attention on the value of the predetermined motion time standard approach.

A somewhat similar procedure was developed by three industrial engineers of the Radio Corporation of America. An article by these three, "Motion Time Standards," by J. H. Quick, W. J. Shea, and R. E. Koehler, which appeared in the magazine, *Factory Management and Maintenance*, in 1945, gave a partial description of their procedure which they called the "Work Factor System." One of the major advantages which they pointed out for their system was that it eliminated the use of the stop watch in determining the time required to do manual work.

A third development in the field of predetermined motion time standards came as the direct result of seeking a solution to the human relations problem mentioned above. At the suggestion of the author, the Westinghouse Electric Corporation sponsored a study beginning in 1940 which led to the development of what is now called the "methods-time measurement procedure" or MTM. It was thought at first that it might be possible to develop a "methods formula" for various classes of work which would make it possible to establish an effective method without having to study an existing job. Accordingly an intensive study was made of sensitive drill-press work. When motion time data were at length compiled, it was found that they applied not only to sensitive drill-press work but to manual work of all kinds, because the same motions were used, as Gilbreth originally pointed out, "in varying combinations and sequence" throughout industry. The research was based on the therblig breakdown of micromotion study, although it was found necessary to redefine several of the basic elements in order to permit the exact measurement of time.

The procedure after several years of careful testing was described for the benefit of the industrial engineering profession in the book *Methods-Time Measurement* by Maynard, Stegemerten, and Schwab published in 1948. It attracted almost immediate attention because the need for such a procedure had long been clearly recognized. The magazine *Fortune* in its October 1949 issue published an article entitled

"Timing a Fair Day's Work" which gave a popular explanation of the MTM procedure. The tables of predetermined motion time standards which they published to show how the procedure works are reproduced here as Fig. 2.

Industrial Engineering and the Worker.—

From the very beginning, industrial workers took a keen interest in industrial engineering because it influenced nearly every phase of their industrial lives. The industrial engineer designed the methods and motion patterns they had to follow to do their work successfully. He trained them to use these methods or at least saw that they were properly trained. He influenced the conditions under which the work was done. He established the time which was allowed for doing the work and established the allowances given for rest, delays, and personal necessities. Finally he often influenced the amount which the worker earned through job evaluation and the application of wage incentives.

Since both industrial engineers and workers are human beings, it was inevitable that there would be a variety of relationships and attitudes among them ranging from complete distrust and hostility to full confidence and respect for one another's viewpoints. Thus it is impossible to say that "labor's attitude is thus and so" and have it be universally true. There has been a variety of attitudes from the beginning, some justified and some unjustified.

Speaking in terms of trends and recognizing that there are always many, many exceptions, it is probably safe to say that the early reactions of the workers to industrial engineering and scientific management were largely emotional. In spite of Taylor's assurances that scientific management resulted in a new emphasis on the importance of the individual workman, there was a tendency to fear it as a device which would reduce the worker to the status of a robot. The stop watch was looked upon as an inhuman mechanism designed to force workers to work at a pace which would quickly wear them out. This emotional attitude which was reflected in much of the management literature prior to 1920 finally caused the Congress of the United States of America to write into its appropriations bills for the Army and Navy in 1915 a clause prohibiting the use of the stop watch and the use of incentives in any Army or Navy installation. This ban persisted for 36 years.

It must be recognized that there was a certain justification for a distrust of industrial engineering. Inept or unscrupulous managements had demonstrated all too clearly that the stop watch could be used to the detriment of the worker. In a few instances, time studies were made secretly, standards were carelessly and inaccurately set, rates were cut when earnings reached a certain level, and the workers were unreasonably speeded up. The malpractices of a few managements damaged the reputation of industrial engineering out of all proportion to their numerical importance.

In addition, the period during and immediately following World War I witnessed the mushrooming into prominence of a number of self-styled "efficiency experts." Among them were a number of unqualified, untrained, unethical individuals who by misapplying a technique which they did not understand did much to damage the name of industrial engineering and to retard its application.

During the early part of the 1920's, industrial engineers had to win back the ground which had been lost. This was accomplished by sound, relatively unspectacular work on the part of a number of technicians, who, convinced of the beneficial results which the procedure, properly applied would bring, pressed for its application at every opportunity. This led to a period of fairly smooth sailing from 1925 to 1930. Management increasingly began to give industrial engineering a permanent place in the organization. In the growing prosperity of the late 1920's, few people questioned the wisdom of technological change. Unorganized labor in fact accepted it as a part of the normal development which was carrying the United States to an undreamed of level of material prosperity. The workers insisted that industrial engineering should be applied fairly and competently, but they raised little objection to any sound work which the industrial engineer wished to do.

In 1930, attitudes began to change again. The growing depression brought fears of unemployment. Suddenly security came to be the thing to be desired above all others. Instead of higher earnings—the factor which had gained acceptance for wage incentives up to that time—steady earnings seemed more important. With only a limited amount of work to be done, many workers began to feel that instead of doing it more quickly, making higher earnings temporarily, and then getting laid off, it was better to do the work more slowly so that it would last longer.

Shortly after 1933 under the encouragement given by the National Industrial Relations Act, unions began to grow in size and strength. In order to attract new members, it became expedient to attack management's activities, to produce grievances, real or imagined, and to promise the workers an immediate improvement in their lot if they would join the union. Industrial engineering lent itself well to attacks inspired by political considerations, and the popular union attitude was to oppose industrial engineering and related practices.

Management's answer to this was to attempt to "educate" its workers with respect to the purposes and fairness of industrial engineering. Courses in work simplification, time and motion study, and the like were held in which the participation of union representatives was invited. This trend fitted in well with labor's desire to have a greater say in the affairs of management. As they learned more about industrial engineering, they asked to have a part in the establishing of standards. They took a keen interest in all matters pertaining to wage incentives and began to have a great deal to say about plans currently in effect and new plans proposed by management. During World War II when wages were controlled by the government, the War Production Board insisted on approving all new wage incentive plans. Before it would consider a new plan, an application for approval had to be submitted jointly signed by both management and the union if a union was involved.

Thus the trend toward the participation of the workers in industrial engineering matters continued. As it developed, the acceptance of the procedure as desirable from both a social and an economic viewpoint grew. When after World War II groups of management and labor people from European countries began to visit the United States under the auspices of the Marshall Plan's

Economic Cooperation Administration, union leaders helped management point out to the visitors the manner in which productivity is increased by industrial engineering. By 1952 when the tempo of the drive for increased productivity in Europe was stepped up by the Mutual Security Agency, successor to ECA, American labor representatives took a leading part in persuading the free labor unions of Europe to accept under certain safeguards sound industrial engineering practices.

Development of Industrial Engineering Techniques.—This keen interest on the part of labor in industrial engineering forced the constant improvement of industrial engineering procedures. For example, the most controversial step in the time study procedure is the one which involves "performance rating." The object of time study is to develop a time standard for doing a specified task which can be met by a qualified operator giving an average or normal performance. If the operator who is being time studied is working at the normal performance level, this is a simple matter. The time obtained from the study is the normal performance time and hence is the desired standard. But when the operator works at a pace which is slower or faster than normal performance, it is necessary to adjust the time values determined by time study to the normal level.

There have been a number of methods used for doing this. The earliest methods were purely mathematical. They called for adjusting the raw time study data by a series of elaborate computations until finally a calculated standard was obtained. The processes were impressive to those who are impressed by slide rules and mathematical computations, but they were for the most part meaningless as industrial engineers soon began to realize. The best of the mathematical procedures were based on the assumption that skilled operators performed each cycle of a repetitive operation in exactly the same time—or in other words were consistent in their performance times—which even casual observation showed was by no means the case. Other mathematical procedures did not have even this much logic behind them. They were all eventually discarded by industrial engineers in favor of procedures which require the time study observer to judge how well or how poorly the operator is working—known as performance rating.

Because performance rating is a subjective procedure involving the element of judgment, it often became a matter of controversy. An industrial engineer could sincerely believe that an operator was giving a below normal performance during a study and would rate him accordingly. The operator with equal sincerity could believe that he was giving a better than normal performance. There was no easy way of resolving this difference of opinion. Other people such as the foreman and the union steward could be called in to check the opinions of the industrial engineer and the operator, but since they too had to rely on the factor of judgment, they were as likely to add to the controversy as to arrive at a satisfactory answer.

The two methods of performance rating which have been most widely used are called "leveling" and "effort rating." Industrial engineers have worked constantly on the refinement of these procedures in an attempt to make them more objective and less controversial.

The leveling method of performance rating was developed in 1925 by Lowry, Maynard, and Stegemerten as an outgrowth of the book they were writing at that time on time and motion study. None of the then existing methods of arriving at standards representing average or normal performance seemed satisfactory to them when they attempted to describe them in their book. Therefore, they set aside their writing for a year and conducted a research study on performance rating.

The first step was to establish criteria for judging performance. The factors which were chosen after study and analysis as affecting performance most importantly were skill—or proficiency at following a given method; effort—or will to work; conditions—i.e., working conditions; and consistency. Skill and effort were seen to have the greatest effect. The range of useful skill and effort was divided into six classes: poor, fair, average, good, excellent, and super skill; and poor, fair, average, good, excellent, and excessive effort.

Each degree of skill and effort was next carefully defined. Average performance was considered to be the equivalent of the fair day's work which is to be received in exchange for a fair day's pay. It represented the effort level which could easily be maintained year in and year out by the physically normal operator without in any way requiring him to draw upon his reserves of energy. It was a pace which appeared somewhat slow when observed and which could be accelerated without too much difficulty under the encouragement of a wage incentive plan.

The operator considered to be giving an average performance with respect to skill was one qualified to do the job who had been at the work long enough to do it without undue hesitation, planning, or errors. He was not noticeably good at doing the job, but neither was he noticeably poor.

When all skill and effort levels had been carefully defined, the cooperation of approximately 175 time study engineers was obtained to determine by actual observation how much time was increased or decreased by performances below and above average. After a year of collecting data, the table shown by Fig. 3 was developed. The "leveling factors" added to 1.00 result in a multiplier which was used to adjust time data obtained during time study to the average performance level.

The effort rating procedure as it is most commonly used rates performance by judging speed of motions. The observed speed is compared with a mental concept of normal speed, and an adjustment factor is arrived at accordingly. If the observer believes that the operator is working 25 per cent faster than the normal pace, he multiplies the time data obtained from a time study of that operator by 1.25 to arrive at the normal time for doing the work.

Both of these procedures and the several variations which stem from them which have been used by industrial engineers required the use of judgment in rating observed performance. In order to improve the consistency with which industrial engineers rated performance, the Society for the Advancement of Management in 1943 set up a Committee on the Rating of Time Studies to study the problem of performance rating and to determine what could be done to improve existing procedures. The committee decided that

Skill			Effort		
+ 0.15 + 0.13	A1 A2	Superskill	+ 0.13 + 0.12	A1 A2	Excessive
+ 0.11 + 0.08	B1 B2		+ 0.10 + 0.08	B1 B2	Excellent
+ 0.06 + 0.03	C1 C2	Good	+ 0.05 + 0.02	C1 C2	Good
0.00	D	Average	0.00	D	Average
− 0.05 − 0.10	E1 E2	Fair	− 0.04 − 0.08	E1 E2	Fair
− 0.16 − 0.22	F1 F2		− 0.12 − 0.17	F1 F2		Poor
Conditions			Consistency		
+ 0.06	A	Ideal	+ 0.04	A	Perfect
+ 0.04	B	Excellent	+ 0.03	B	Excellent
+ 0.02	C	Good	+ 0.01	C	Good
0.00	D	Average	0.00	D	Average
− 0.03	E	Fair	− 0.02	E	Fair
− 0.07	F	Poor	− 0.04	F	Poor

FIG. 3. Leveling factors for performance rating.

rather than attempting to develop a new procedure, it could perform the greatest service by developing a set of standards against which any industrial engineer could check his own concept of normal and determine in general how he was rating performance in comparison with other industrial engineers.

Aided financially by industrial companies who appreciated the seriousness of the performance rating problem, the committee prepared a number of motion pictures of people working at various performance levels. They had these motion pictures rated under carefully controlled conditions by over 1,200 experienced time study engineers. Statistical treatment of the resulting data provided a series of bench marks against which any individual engineer could check his own concepts of performance levels. The motion picture films were made available for purchase by industrial companies to be used for training purposes. They proved to be an aid in improving the consistency with which a group of engineers judged performance and were used with good effect in developing a common concept of normal performance among industrial engineers, supervisors, and operators.

The effort to improve and refine industrial engineering techniques was by no means confined to the United States. In the field of performance rating, for example, important studies were made and reported upon in 1950 by engineers in Switzerland and France. In the field of predetermined motion time standards—where incidentally the problem of performance rating is largely eliminated—although the major developments came out of the United States, important contributions to the general fund of knowledge about motions and motion times were made in England, France, Holland, and Germany.

The fact that industrial engineering is used throughout the world presents a continuing problem in international standardization. Problems in terminology became so serious, for example, that in 1950 the International Committee on Scientific Management, CIOS, set up a subcommittee on the Standardization of Management

Terminology to begin work on eliminating what had been called "Management's Tower of Babel."

In the United States, similar activities were undertaken to bring a better degree of standardization and understanding to the industrial engineering field. The terminology project of the Work Standardization Committee of the American Society of Mechanical Engineers (ASME) has already been mentioned. This same society in 1941 established a Committee for the Standardization of Therbligs, Process Charts, and Their Symbols. Some idea of the difficulties of bringing about standardization in a vigorous and rapidly expanding field like industrial engineering may be gained from the fact that this committee worked six years, held innumerable meetings, and carried on lengthy correspondence with numerous industrial engineering authorities in the United States and Canada before it felt ready in 1947 to publish its first ASME Standard on *Operation and Flow Process Charts*.

Such activities, however, difficult as they are, have helped to develop the "universal language" which is so essential in scientific fields. The first page of the ASME Standard on *Operation and Flow Process Charts* illustrates how clear definitions and standardized symbols and terminology have sharpened this particular tool of industrial engineering. It reads as follows:

SECTION 1 PROCESS CHART

DEFINITIONS

1. *Process Chart*. A process chart is a graphic representation of events and information pertaining thereto occurring during a series of actions or operations.
2. *Operation Process Chart*. An operation process chart is a graphic representation of the points at which materials are introduced into the process and of the sequence of inspections and all operations except those involved in material handling. It includes information considered desirable for analysis such as time required and location.
3. *Flow Process Chart*. A flow process chart is a graphic representation of the sequence of all operations, transportations, inspections, delays, and storages occurring during a process or procedure, and includes information considered desirable for analysis such as time required and distance moved.
 - (a) The material type presents the process in terms of the events which occur to the material.
 - (b) The man type presents the process in terms of the activities of the man.

PROCESS CHARTING PROCEDURE

4. For analytical purposes and to aid in detecting and eliminating inefficiencies, it is convenient to classify the actions which occur during a given process into five classifications. These are known as operations, transportations, inspections, delays, and storages. The following definitions cover the meaning of these classifications under the majority of conditions which will be encountered in process charting work.

ACTIVITIES DEFINED

5. *Operation*. An operation occurs when an object is intentionally changed in any of its physical or chemical

characteristics, is assembled or disassembled from another object, or is arranged or prepared for another operation, transportation, inspection, or storage. An operation also occurs when information is given or received or when planning or calculating takes place.



6. *Transportation*. A transportation occurs when an object is moved from one place to another, except when such movements are a part of the operation or are caused by the operator at the work station during an operation or an inspection.



7. *Inspection*. An inspection occurs when an object is examined for identification or is verified for quality or quantity in any of its characteristics.



8. *Delay*. A delay occurs to an object when conditions, except those which intentionally change the physical or chemical characteristics of the object, do not permit or require immediate performance of the next planned action.



9. *Storage*. A storage occurs when an object is kept and protected against unauthorized removal, shown by inverted triangle.



10. *Combined Activity*. When it is desired to show activities performed either concurrently or by the same operator at the same work station, the symbols for those activities are combined, as shown by the circle placed within the square to represent a combined operation and inspection.



11. When unusual situations outside the range of the definitions are encountered, the intent of the definitions summarized in the following tabulation will enable the analyst to make the proper classifications.

Classification	Predominant Result
Operation	Produces or Accomplishes
Transportation	Moves
Inspection	Verifies
Delay	Interferes
Storage	Keeps

Wage Incentive Plans.—Frequent mention has been made of wage incentive plans because they have been an important part of industrial engineering activities since the time of Taylor. A review of the way in which wage incentive philosophies altered between 1900 and 1950 will help in understanding more clearly the changing, growing character of industrial engineering.

The period between 1900 and 1930 saw the reputation of industrial engineering sink to a low level as the result of rate cutting, the fumblyings of the so-called "efficiency experts," and a variety of questionable practices on the part of some managements. It rose again as sound practitioners quietly demonstrated that industrial engineer-

ing properly applied could benefit everyone. The wage incentive installations of this period all had one feature in common. They were made largely as the result of unilateral decisions. If management decided to install an incentive plan, it selected the plan, established the standards, and started the plan in action at the time which best suited its own convenience. True, the more advanced managements endeavored to "sell" the plan to the workers, but the product was largely management's product designed without benefit of market research to see what the customer—that is, the worker—really wanted.

In doing the selling, the principal benefit which was offered was increased earnings. This fitted the philosophy of the times quite well. Rugged individualism was popular and everyone was interested in making more money for himself. So the money benefit was accepted, and the incentive which it provided caused the workers to pitch in and make even a poorly conceived wage incentive plan work reasonably well.

The depression of the 1930's intervened to make security seem more important than higher individual earnings. This period did not last long, but it had a profound effect on those who lived through it. Management's attitudes were shaped by the 1920's. They wanted to continue to make unilateral installations; they continued to rely on the appeal to the desire of the individual to make higher earnings in selling wage incentives to the workers. But the workers had changed their minds about the rightness of high individual earnings. They were even at that moment not quite sure that high productivity in general was socially desirable. So the stage was set for trouble as the unions began to grow, with enough tensions on both sides to cause many, many difficulties.

To overcome these difficulties, different solutions were tried. One which attracted a great deal of attention from 1934 to 1938 was in the automobile industry where the attempt was made to overcome the problems caused by direct incentives by going to measured day work. At the beginning of the change-over, the workers agreed that if they were paid the average earned rate they had received in the past they would continue to maintain their same output. They even agreed that the worker who did not keep up could be discharged. To management, this seemed to be the solution to many problems. Inconsistencies in earnings would immediately be eliminated. Because earnings were not tied directly to a standard, it was felt that the pressure would be taken off the industrial engineer and management for complete accuracy and that a better human relations situation would result.

But it did not work out that way. Human nature being what it is, little by little performance deteriorated. The burden of proof as to whether a given performance was acceptable was on management, and it became increasingly difficult to enforce high effort by disciplinary measures. The net result of measured day work, therefore, was a performance level which gradually fell toward the unmeasured day work level. Companies which were able to evaluate the results reported that production fell off by at least 25 per cent.

In spite of all of the problems involved, many companies continued to use and expand their use of wage incentives all through the difficult 1930's. They paid an increasing amount of attention to

method, they strove for greater accuracy in setting standards, they gave guarantees which eliminated certain abuses of the past, and more and more they consulted with their workers on wage incentive problems, either voluntarily or as the result of union pressure. They demonstrated that wage incentives, properly and intelligently administered, still brought good results, and they paved the way for the next development which came at the beginning of World War II.

At that point, the need for greater production suddenly became apparent to nearly everyone. The make-work and slow-down attitudes born of the depression did not die immediately, but they were more or less pushed into the background for the duration. The War Production Board, desperate for more and more production, strongly advocated the use of wage incentives under certain conditions. The conditions were drawn up by men who understood wage incentive problems and served to create an understanding of sound wage incentive practices among a much larger segment of the industrial population than before.

As has been pointed out, in order to get approval for a new incentive plan, it was necessary to submit an application to the War Production Board signed by both management and the union if a union was involved. This meant that management could no longer take unilateral action. It was necessary to consult with the union about every detail of a proposed plan before the union would agree to go along. The industrial engineer was forced to develop his plans much more thoroughly than before; make accurate appraisals of the effect of the plan on production, earnings, and working conditions; and then by effective selling techniques in which the interests of the prospect were put above the interests of the salesman gain acceptance for his proposed course of action.

These wartime experiences helped to develop the industrial engineer to a state of greater effectiveness in the postwar period. He came to recognize clearly that his wage incentive plan had to be tailored to the needs and basic beliefs of the group who were to work on it. He had to become a human engineer as well as a technical engineer. But the net result was good. In addition to becoming a broader, more understanding man himself, his installations tended to receive greater acceptance from the workers. A big step forward toward more mature relations between workers and the industrial engineer had been taken.

Application of Industrial Engineering.—Industrial engineering procedures were first applied largely to highly repetitive work. It was entirely obvious that if a large number of identical parts had to be manufactured, it would pay to study and improve the methods by which they were produced, establish time standards, and introduce a wage incentive plan which would encourage high production through the payment of high earnings.

The early installations on highly repetitive work were so successful, however, that both management and the workers wanted them extended to less repetitive work. Management wanted the cost reductions which such installations bring. The workers on less repetitive work, seeing the higher earnings of those on the repetitive jobs, asked for the same opportunities to increase their pay.

For the industrial engineer, this situation

offered both an opportunity and a challenge. It offered an opportunity to extend the field of his service. At the same time, it presented a challenge to find better and quicker methods of doing his own work so that it would be economically justified. On low quantity work where only a few of a given part were produced, it obviously would be impractical to time study each operation in detail. The work would be completed long before the time studies could be worked up and the standards computed.

The solution to this problem was found in the development of standard data or time formulas. These are compilations of time study data obtained by time studying representative jobs in a given class of work, arranged so that they can be used for establishing standards for similar jobs which have not been time studied. Time formulas reduce the time required to establish a standard. The time required to make and work up a time study on repetitive work is commonly from 1 to 4 hours where the length of the operation cycle is fairly short, and may be much longer on larger work where one operation cycle may run as high as 100 hours. The time required to establish a standard from a time formula will in most cases range from 1 to 15 minutes.

The formula approach was suggested by Taylor, but industry was somewhat slow to use it. There were two reasons for this. On many classes of work, the derivation of a time formula is a fairly complex task. It is not easy for one who has no training in time formula work to understand how it is possible to develop a formula which will permit the establishing of accurate and consistent standards on an irregular activity such as, say, storeroom work. Therefore management was slow to authorize time formula derivation activities. The second obstacle was the length of time required to develop the time formula which on the average was about three months. It required considerable patience on the part of management and workers alike to wait while the engineer went through what seemed to be an endless series of studies and computations before the first standard could be set and incentive payment begun.

In spite of these obstacles, however, the use of standard data and time formulas spread, and standards and wage incentives were introduced on less and less repetitive work. With the coming of predetermined motion time standards, the time required to develop a time formula was sharply reduced, sometimes to as little as two weeks. This gave further impetus to the use of formulas. Applications spread from low quantity production work to such indirect labor operations as tool making, maintenance work, shipping and receiving, janitor work, and the like. The benefits to be derived from industrial engineering were found to be just as substantial on indirect labor operations as on direct labor operations.

Although industrial engineering has always been most widely used in factory work, it has been used for office work as well. It has also been applied with good results to distribution activities, particularly by the oil industry. Outside industry, industrial engineering applications have been made to all manner of activities where human labor is involved—in hospitals, homes, libraries, wholesale and retail establishments, and the like. Notable applications to agricultural work have been reported from Sweden, Hawaii, and the United States. By the end of the first

half of the 20th century, it was evident to people in every country and in every walk of life that industrial engineering had much to contribute to the continuing raising of standards of living throughout the world.

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INDUSTRIAL HOUSING. With the growth of motor transportation and the entrance of government into the field, industrial housing has lost the clear definition it once had, the housing of workers by employers. Today company housing in the older sense is likely to be instituted only in the most isolated areas, for a mine or a new power development.

The term industrial housing is now applied in the United States, by extension, to any housing planned for workers in industry (not necessarily urban), whether by federal or other government agency, employers, or private agencies, with or without the aid of public funds. Such projects are likely to be large apartment or garden apartment structures, rather than the single-family dwellings they usually were in Great Britain during the Industrial Revolution and in the early mill towns of New England, built by the mill owners to attract help to new industries.

Nowadays the tenants pay rents which cover a good deal, if not all, of the expense of construction, maintenance, and financing. The old company housing was often rent free or charged only nominal rents. Under this arrangement the worker occupied the apartment at the discretion of the employer, and often had to waive state and local eviction restrictions as part of the original occupancy agreement. As a result eviction was a powerful weapon in the hands of the employer during industrial strife, and the tent colony was a common feature of large strikes. For this reason, and because many workers resented having the same man or company as both employer and landlord, they sought lodging elsewhere as soon as it became available. Commercial speculative housing, usually in the form of two- or three-story frame railroad or shoe-box flats, detached or semidetached, sprang up everywhere in the United States.

In Europe through the 19th century there was a greater tendency to combined company-government housing corporations, in addition to schemes which encouraged the purchase of company-built housing by employees or the setting up of employee cooperatives for the purpose. The German Krupp firm started a housing program in 1861, which by 1919 housed 12,000 families, making loans to employees. One of the model company towns, including landscaping and recreation facilities, was begun in England in 1895 by the Cadbury chocolate interests.

In the United States the Pullman development, now part of Chicago, while a great improvement

over most company and speculative housing in plan and recreational provisions, included the worst elements of paternalism in its extreme regulation of the lives of residents—forbidding saloons, for example. A more enlightened philanthropic project was that of Nelson Olsen Nelson at Le Claire, near St. Louis. Gary, Ind., founded in 1906, is the most spectacular example of a company town.

Company Town.—Little good has been said by sociologists about the company town. The absence of genuine community organizations, the centralized control of civic functions by direct or indirect employees of the controlling company, the frequent evil of the company store, which encouraged indebtedness and charged higher than prevailing prices, are well-known abuses. Often the police force, schoolteachers, and even the clergy were maintained by the company and were regarded as its instruments.

The development of the automobile, permitting the worker to live some distance from his job, helped break up the direct control of the town by the controlling local industry, although indirect control, as depicted in the sociological study *Midletown* (1929), continues. During World War II the car pool and the trailer camp made it possible to locate new factories in isolated regions without provision for housing all the plant's expected workers.

Early Industrial Housing.—Industrial housing began with the need to provide for workers in the new manufacturing villages which grew up in the 18th century, especially in England, where watercourses supplied power for textile machinery. Often these factories were some distance from established centers of population, and provided both employment and housing, at minimum standards, for former farmers and villagers who had been put off the land by enclosures. The houses, minimal and brutally congested, became one of the blights of the Industrial Revolution, and conditions worsened when coal became the prime motive power, as company housing was huddled close to the factories, with no concern for zoning, or for light and air. In England as late as 1925 about one third of the miners still occupied company houses.

In the United States the mill in Pawtucket, R. I., planned by Samuel Slater in 1790, began a similar process. At first mills only turned raw cotton into yarn, with the weaving performed by farmers in their cottages. After 1815 the complete factory, with all processes under one roof, came into being, and with it the need for company housing. Originally there was a certain community of origin and feeling between employer and employee, with some feeling of mutual responsibility; but as industry grew, and absentee landlordism with it, housing standards fell. Then immigrants from Europe were welcomed to man the machines, first the Irish, then workers from eastern and southern Europe, and the Lawrences of the new era became "pay envelope" cities, as the employer's concern in his employees ceased at the mill gates. The speculative builder moved in; wooden three-deckers took the place of the cottages and the "back alley" became crowded with tiers of flats.

World War I Period in the United States.—During World War I the United States began to catch up to the example of European nations in providing housing for workers in essential industry. One agency, the Emergency Fleet Corpora-

tion, employed government architects and encouraged subsidized company housing. It actually carried some of its projects to the point of having them occupied, and continued operating after the armistice, as ships continued building. Another federal agency, the United States Housing Corporation, started later and curtailed and canceled its projects when the war ended.

An interesting wartime project was the Bayonne Housing Corporation, founded by a group of leading industrialists at a meeting on Oct. 4, 1917, to provide decent housing for oil workers, at moderate but unsubsidized rentals. The first group of houses was completed in 1924-1925, after the New Jersey tenement house law and the local building code had been amended to allow the building of garden apartments. Recognizing that the basic problem of housing was the cost of financing and the desire for quick pay-off of investment, the project was planned for long-term funding. The H-shaped buildings covered only 36 per cent of the site, in conscious contract with other workers' apartments covering 70 to 80 per cent. The Bayonne project was eventually sold to a private entrepreneur.

Modern Industrial Housing.—In World War II the United States government moved more quickly, and many federal projects were put up at shipyards, aircraft factories, and other large plants, and there was useful experimentation in new materials and types of housing, in an attempt to save both time and cost. After the war the role of the government in financing housing by insuring bank investments was one of the foundations of large-scale building.

The devastation of Europe in the war forced much construction into the hands of government agencies, aided by shipments of American materials and equipment. The result was the establishment of standards of space and equipment. In the Communist countries of eastern Europe all housing is, of course, a government function, and great public emphasis was put on the replacement of destroyed housing by workers' apartments.

By their very nature, such enterprises as mining and lumbering, far from inhabited centers, require special housing programs for employees. At first the roughest and most primitive imaginable, such housing improved as the living conditions of workers became part of union contracts. A new development of the isolated project is the housing of American construction workers during the establishment of United States airbases and other installations all over the world, and then of civilian workers at such bases when completed. For example, at the airbase at Goose Bay, Labrador, before a spade could be turned, living quarters had to be established for a construction force of 5,000 men. Besides barracks and mess hall facilities, a movie theater, library, and Hudson Bay store were provided. A more significant development in industrial housing is the epoch-making Kitimat power and aluminum project in British Columbia, Canada. A city for 50,000 people, with homes, shops, and schools, was laid out by Clarence Stein for the Aluminum Company of Canada, in preparation for future workers at a plant built in the wilderness.

A modern variation of the company town is Fairless, Pa., made up of the prefabricated Gunnison houses manufactured by the United States Steel Corporation, and occupied by employees of the company's Morrisville plant. Unlike the classic company town, these houses are occupied

in great part by white-collar workers, and the financial arrangements involve purchasing the dwelling with the assistance of the employer. Apart from such special examples, the company town planned from the start by the employer for his workers is becoming an incident in the past growth of industry.

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INDUSTRIAL HYGIENE. The application of the combined techniques of engineering, chemistry, physics, and medicine to the control of the environment of the industrial worker, in order to protect his health, is the major concept of industrial hygiene. Employment of medical and nursing principles to improve the health of a group of employees, entirely apart from any occupational hazards, is a secondary concept.

Infectious diseases, with a few exceptions, are not typically occupational in origin and are not a major concern of the industrial hygienist. Occupational diseases, prevention of which is the chief purpose of industrial hygiene, are most commonly caused by dusts, fumes, vapors, gases, irritating chemicals, and abnormal physical factors in the environment of the worker.

Dust Diseases.—*Silicosis*, a disease of the lungs caused by inhalation of dust containing free silica, is perhaps the most important occupational disease. The American Public Health Association defines silicosis as a "disease due to breathing air containing silica (SiO_2), characterized anatomically by generalized fibrotic changes and the development of miliary nodulation in both lungs, and clinically by shortness of breath, decreased chest expansion, lessened capacity for work, absence of fever, increased susceptibility to tuberculosis. . ."

Ordinarily silicosis is developed only after several years of work in a dusty environment; but when dust concentrations are unusually high, it may follow exposure of only a year or two. Combined silica (silicate) does not cause silicosis. The form of free silica most commonly encountered in nature and responsible for most cases of this disease is quartz. Occupations in which silicosis may present a hazard include mining, tunneling, stonecutting, pottery manufacturing, sandblasting, and other foundry operations.

Asbestosis is a lung disease caused by inhalation of asbestos fibers. The changes produced are unlike those of silicosis. The fibrosis is diffuse and not nodular, and there is less susceptibility to tuberculosis. However, there is evidence that asbestosis may be associated with lung cancer.

Byssinosis is a lung disease contracted by cotton mill workers, especially in England.

Siderosis is a nondisabling condition characterized by a deposit of iron oxide in the lungs, frequently observed among welders and miners of iron ore.

Berylliosis results from the inhalation of beryllium oxide and certain other beryllium compounds. While its chief symptoms refer to the respiratory tract, it is considered by some authorities to be a systemic disease. The greatest concentration of cases has been in the fluorescent lamp industry, where the phosphors (fluorescent powders) used to coat the inside of the lamps formerly

contained beryllium. Short exposure to high concentrations of beryllium compounds, particularly soluble compounds such as the fluoride, may result in pneumonitis. Both forms of the disease are frequently fatal.

Heavy Metal Poisoning.—*Lead poisoning* ranks next to silicosis among occupational diseases. Formerly it was associated chiefly with the painting trade; now it is rarely encountered among house painters, but is found frequently in such diverse industries as storage-battery manufacturing, nonferrous foundries, lead smelters and refineries, plastics manufacturers, and automobile assembly plants. The commonest symptoms are colic, weakness of the wrists, and anemia.

Mercury intoxication, as observed in industry, usually results from inhalation of the vapor. It was formerly common among felt hat makers, who knew it by the descriptive term, "hatter's shakes." Many countries and various states of the United States ban the use of mercury-treated fur for hat manufacturing; but there are many other industrial uses of mercury.

Manganese poisoning from the inhalation of high concentrations of the dust of manganese compounds may result in damage to the nervous system and partial paralysis. Typical symptoms are a stumbling gait and mask-like facial expression. The disease is most prevalent in smelting and mining operations.

Cadmium poisoning most frequently results from inhalation of fumes of heated cadmium, and takes the form of a severe chemical pneumonitis. Chronic cadmium poisoning among workers engaged in the manufacture of cadmium-nickel storage batteries has been reported in Sweden and France.

Zinc fume fever is a transient illness resulting from inhalation of freshly formed fumes of zinc oxide. It occurs chiefly among brass founders and welders of galvanized metal.

Other heavy metals, such as arsenic, vanadium, thallium, and uranium, are toxic and produce occasional occupational intoxications.

Organic Solvents.—*Benzene*, or benzol, is one of the most dangerous of the common solvents. Absorption of the vapor not infrequently results in blood changes which may progress to aplastic anemia, a fatal disease. Because of its toxicity, the use of benzene in rubber cements and lacquer formulations has been virtually abandoned in the United States; but it is still employed in paint removers and as a raw material in the chemical industry.

Carbon tetrachloride, widely used as a cleaner because it is volatile and will not burn, is a dangerous kidney and liver poison. At present it is probably the number-one toxic solvent problem in the United States.

Carbon disulphide was formerly used in the rubber industry, but is now found chiefly as a raw material in viscose rayon manufacture. It produces mental symptoms, leading in extreme cases to insanity. Major episodes of carbon disulphide poisoning have been reported in Poland and Italy.

Other solvents which have produced serious occupational intoxications include tetrachlorethane, ethylene chlorohydrin, and dioxane.

Pesticides.—The use of toxic chemicals to control insect, fungus, and rodent pests has created some serious occupational hazards. Methyl bromide, a gas used as a fumigant, also to some extent as a fire extinguisher, damages the central nervous system and also is a lung irritant. Parathion,

one of the most effective insecticides known, has proved to be extremely dangerous to handle. DDT, on the other hand, has not proved especially hazardous to workers.

Occupational Cancers.—The hydrocarbons present in coal tar, and in some oils derived from petroleum, are markedly carcinogenic, at least to the skin. Cancer of the scrotum was formerly a not uncommon affliction among chimney sweeps in England. Mule spinners in that country frequently contracted the same condition by contact with lubricating oil. Tumors of the bladder, found in abnormal frequency among workers in dye plants, have been traced to betanaphthylamine and benzidine. Aniline, which was formerly blamed, has been shown not to cause this disease. A high incidence of lung cancer has been observed among workers in plants manufacturing chromates. The exact compound responsible has not been definitely determined. So far there have been no similar reports from other industries in which chromium compounds are used. Arsenic compounds have been reported to cause cancer of the skin and also of the respiratory organs.

Radioactive substances are among the most dangerous carcinogenic agents. A very high death rate from cancer of the lung has been observed in uranium mines in Czechoslovakia where high concentrations of radon were present in the air. Tumors of the bone developed in many workers who used radioactive luminous paints without proper precautions. These individuals had absorbed radium, which was deposited in the bones.

Skin Diseases.—Dermatoses, or diseases of the skin, are the commonest of occupational diseases. The most frequent causes are solvents, oils, and alkalis. Substances whose use is frequently associated with outbreaks of dermatitis include chromates, *p*-phenylene diamine, and hexamethylene tetramine.

Infectious Diseases.—A few of the infectious diseases are frequently occupational in origin, such as anthrax (wool sorters and tanners), Weil's disease (fish handlers, sewer workers), and brucellosis (slaughter-house employees).

Illness from Physical Conditions.—Physical conditions which may bring on occupational illness include excessive temperatures (heat stroke), high atmospheric pressures (bends), ultraviolet and infrared radiation (eye injury and skin burns), and X-rays and radiation from radioactive sources. The latter may cause blood changes, skin burns, blindness, and, as noted above, cancer.

TESTING AND CONTROL

Air Analyses.—The essence of industrial hygiene is the measurement of harmful conditions, particularly the concentration of dusts, fumes, gases, or vapors in the workroom atmosphere.

Mineral dusts are determined by a counting procedure. Ordinarily only the particles below a certain size (5 to 10 microns in diameter) are considered significant. In the United States an impinger containing water or alcohol is commonly employed for collecting dusts. A small amount of the suspension is placed in a shallow cell and the number of particles counted under a microscope. Frequently a light-field setup is used. In England the dust is usually collected dry in a thermal precipitator. In South Africa a konometer, a dry impingement device with a built-in microscope, is widely employed.

Dust concentrations are expressed as numbers of particles per cubic centimeter of air or as

millions of particles per cubic foot of air. Concentrations will range from less than a million particles per cubic foot in air that is relatively free from dust, to several hundred million in highly dusty operations.

Toxic dusts and fumes, such as those from lead, cadmium, and manganese, are usually determined chemically. They may be collected by means of the impinger, with a portable electric precipitator, or on a filter paper. Concentrations are expressed in milligrams per cubic meter of air, and micro-methods of analysis are usually necessary to determine the small amounts of substance present.

Vapors can be adsorbed on activated charcoal or silica gel, and then determined by chemical or physical methods. Flammable vapors can be measured directly by means of a portable detector. Instruments are also available for the direct determination of chlorinated hydrocarbon vapors, and the portable interferometer can be used for the field estimation of many vapors.

Gases are usually absorbed by bubbling the air through a suitable chemical reagent. However, direct chemical testing devices are available for certain gases and vapors in the air, such as carbon monoxide, hydrogen sulphide, benzene, and sulphur dioxide.

Biochemical Tests.—Analysis of urine or blood for toxic substances is an alternative method of measuring exposure. Urinalyses are useful for such heavy metals as lead, mercury, and uranium. The ratio of inorganic to total sulphates (urine sulphate test) is affected by absorption of benzene. The blood contents of lead and of carbon monoxide (carboxyhemoglobin) are useful indices of exposure to these substances. The radon content of expired air is a measure of the radium stored in the body.

Tests to indicate early damage to the body or changes which precede measurable damage are also employed. Examples are chest X-rays to detect early stages of silicosis, asbestosis, and other occupational lung diseases; measurements of methemoglobin in the blood to determine effects of nitrobenzene and allied substances; tests of the cholinesterase activity of the blood, which are a delicate index of absorption of the organic phosphate insecticides, such as parathion. Coproporphyrin in urine is a sensitive test for very early stages of lead poisoning.

Control Measures.—Pre-employment and periodic medical examinations are advisable for workers in occupations in which harmful dusts, fumes, or radiations are present. Individuals with a predisposition to the disease caused by a given agent should avoid an occupation in which it is present in sufficient concentration to produce a hazard. Removal of workers from hazardous exposures at the first sign of illness may prevent the disease from becoming serious. This phase of industrial hygiene often finds the medical profession and organized labor in conflict, since transfer of a worker from a hazardous occupation in which he is skilled to a safer occupation may involve economic hardship.

When a health hazard is shown to be present, by air tests, bio-assay, or other procedures, reduction or elimination of the exposure is indicated. The chief methods of achieving this end are as follows:

(1) Substitution of a less toxic material. Examples: use of steel shot for sandblasting in place of sand (quartz); substitution of naphtha for benzene in rubber cements.

(2) Isolation: enclosure of process to prevent dissemination of dust or vapor into workroom air.

(3) Wet methods: especially where dust is produced; notably effective in underground drilling.

(4) Local exhaust ventilation: removal of dust or fume as it escapes from the process, before it has a chance to be dispersed into room air.

(5) General ventilation: dilution of the air in the room with fresh air to reduce the concentration of atmospheric contaminant.

(6) Personal protection devices: respirators, gas masks, or air-supplied hoods or helmets, where the hazard is a dust or fume; gloves, aprons, or other protection where contact with a corrosive or irritating chemical is the problem.

As a rule, substitution of a relatively non-toxic substance is the most satisfactory solution, and use of respirator devices least satisfactory. Local exhaust ventilation is the solution most frequently applied.

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INDUSTRIAL INSURANCE. See LIFE INSURANCE—5. *Types of Insurance and Policies.*

INDUSTRIAL OR LABOR RELATIONS IN THE UNITED STATES. Industrial relations usually means the relationships between employer and wage worker which, with the rise of the factory system, large-scale modern industry, and the corporation after the Civil War, succeeded historically earlier relationships between master and servant and owner-manager and his few employees. The term is applied primarily to relations between management and labor in the manufacturing, extractive, transportation, communications, and distributive industries. In accordance with this usage, employer-employee relationships in other fields are commonly called labor relations; but the distinction is haphazard, for the two terms are also used interchangeably.

Considered in its more restricted meaning, "industrial relations" nevertheless includes a vast complex of diverse, varying, interacting, and interpenetrating relationships. Among essential aspects of industrial relations are wages and hours; labor and social legislation; vocational training; scientific management; inter-racial relationships; collective bargaining; the scope and power of employer organizations and combinations; the strength and status of trade unionism and the influence of the labor movement; labor-management disputes, and voluntary arbitration and government mediation and conciliation; strikes, the status of civil liberty, intervention by the state, and government seizure and operation of privately owned industry; and management

and labor representation in government economic and industrial administrative bodies.

A Modus Vivendi Between Capital and Labor.—In their totality, these relations signify a *modus vivendi* between capital and labor whereby the production and distribution of goods and services are carried on under increasing governmental regulation. But it is a dynamic equilibrium which is the result of a long period of development and which, moreover, is in process of continual change.

The complex character of contemporary industrial relations stands in sharp contrast to the comparatively simple relationship which obtained between employers and employees during the early stages of the industrialization of the United States in the latter part of the 19th century. Basically, that relationship was an unwritten express or implied contract between the employer, who was increasingly a corporation, regarded at law as a juristic person, and the employee, who was invariably an individual. Payment of wages by the employer for work performed by the employee were the principal terms of the contract. Theoretically, employer and employee were equal parties, free to bargain for terms, and acquired equal rights and duties. Actually, however, the employer, because of superior economic strength over the individual employee—whose only marketable asset was his ability to work and who had no alternative but to work—possessed decisive bargaining advantages and dictated the terms of the contract, subject only to the loose and variable control of the competitive system. Owing to the relatively elementary state of industrial development, the rules governing work, formulated by the employer, were correspondingly simple.

Scientific Management.—Three basic factors profoundly modified the development of industrial relations to their present state. The first was the rapid technological revolution which made United States industry the most productive in the world. The development of vast enterprises employing first thousands, then tens of thousands, and, finally, hundreds of thousands of workers, made necessary complex codes of rules governing working conditions. Precision and smoothness are vital in the operation of mass-production industries. Economies made through division of labor and specialization are jeopardized by interruptions to the flow of work arising from absenteeism, tardiness, lack of discipline, and lack of efficient coordination on the part of management.

From these needs arose the theory and practice of scientific management. Originally, scientific management was limited in its basic aim to the achievement of increased productivity through improvement in the skill of the labor force and in the planning and coordinated operation of production. Subsequently, scientific management was extended to include the development of co-operation between capital and labor through cultivation of good will of both parties toward each other. Included in this sphere are establishment of fair standards of work; determination of appropriate, as well as effective, incentives for work; selection of personnel in accordance with the aptitude of workers for various positions and tasks; and a degree of cooperation between management and workers in the practical solution of these problems. Involved in this extension of scientific management are the application to in-

dustrial relationships of the principles of psychology and, in later years, of some tenets of psychiatric science. A further and important development of scientific management has been the cultivation, through public relations, of good will on the part of communities and consumers, both as an advantageous aid in the sale of products and services and as a practical application of a sense of social responsibility toward the public.

Trade Unionism.—The second factor in shaping the evolution of industrial relations was the development of the trade-union movement. For the arbitrary determination by the employer of the terms of the labor contract, the workers sought to substitute collective agreements between employers and workers organized in unions. Thereby labor expressed its desire for a higher standard of living and an improved status in United States society. And it sought to apply to industry the elementary principles of traditional American political democracy.

Its first efforts were confined to wages, hours, and measures to protect health and life while at work. These are still basic considerations in collective agreements, but they are now far from being the exclusive considerations. Gradually, as unions grew in size, strength, and influence and came to be accepted as socially necessary institutions performing valuable functions, the scope of labor's role increased and was reflected in collective agreements, which included, in addition to provisions relating to wages and hours, terms concerning sickness and death benefits, pensions, vacations, methods of employment, limitations on management's right to discharge workers, rules regulating work, and other matters.

Labor and Social Legislation.—Simultaneously, labor demanded of the state that it curb industrial autocracy and further the purposes of labor by the establishment of minimal standards, the provision of various benefits designed to afford workers a measure of security against the uncertainties inherent in the modern industrial system, and the creation of specific labor rights and immunities. Through collective agreements and legislative enactments, the powers and rights of management were limited and the position of labor improved.

Labor-Management Cooperation.—Although unions had been recognized by the courts since the 1840's as lawful combinations, their legal status was long undefined by statute and they had no standing before the courts as parties in suits over the enforcement of contracts. They were strongly resisted by employers. The history of this phase of labor relations is in large part a record of conflict which frequently culminated in violence and often in bloodshed. With the passage of time, however, management learned to accept unionism as a permanent feature of industrial relations and to cooperate with it; while organized labor, once established and relatively secure in its acceptance, tended, for its part, to demonstrate a sober sense of responsibility with respect to its obligations to management and the preservation and enhancement of the national economy. Progressively greater emphasis was placed by both sides on conciliation and arbitration than on lockouts and strikes as means of solving disputes, and some industries in which conflict had been frequent, experienced as much as a quarter of a century of industrial peace.

The Government in Industrial Relations.—A profound change in the rôle of government

was the third basic factor in determining the course of industrial relations. In the prevailing views and attitudes of the latter part of the 19th, and the early years of the 20th, century, the regulation of industrial relations, as of economic relationships generally, was excluded from the functions of government. The regulation of industrial relations was held to be the concern of industry and labor. Only when they dramatically affected the public interest, as in the serious disturbance of public order in large-scale strike violence, were industrial relations considered a proper concern of government.

However, as the growing economy of the United States became increasingly complex, and vast corporate enterprises, in pursuit of their private interests, vitally affected the public welfare, the need for regulation of economic processes by the government became pressing. Participation by the government in industrial relations, following the economic crisis of 1929, formed an important part of the measures undertaken by the federal government under President Franklin D. Roosevelt to cope with the depression.

The essential features of the new policy with respect to industrial relations, which was intended to promote industrial peace, were statutory affirmation of the right of labor to organize, to bargain collectively, and to strike; prohibition of interference with these rights on the part of employers; and establishment of agencies for the mediation, conciliation, arbitration, and administrative disposition of disputes between management and labor. Sweeping regulatory powers over economic relationships, including industrial relations, were vested in the president during World War II. After the war, governmental participation in industrial relations was extended by Congress. By the terms of the Labor Management Relations Act of 1947 (the so-called Taft-Hartley Act), unions achieved definite legal status as parties to contracts; the rights of employers in industrial relations were redefined more favorably, and the rights of labor were partly restricted; and the scope of governmental intervention in strike situations was enlarged.

The Labor Contract.—In its basic legal aspect, the capital-labor relationship is a contract in which the contracting parties are the employer and employee. As shown above, the emergence of the labor contract marks the outcome of efforts to preserve individual bargaining as the exclusive or paramount mode of defining the employment relationship, and of counterefforts to introduce controls over the bargaining process intended to offset the disadvantage of labor.

The upshot has been the development of labor and social legislation and collective bargaining. Statutes and administrative enactments and judicial decisions made thereunder greatly restrict the freedom of the parties in bargaining by establishing minimum limits for the terms which enter into labor contracts, determining conditions under which labor contracts are negotiated, providing for the disposition of labor-management disputes, and restricting the right, primarily of employers, but also to some extent of employees, to enter into and to terminate labor contracts at will.

Collective-bargaining agreements are similar in effect. Formerly, they were not regarded as contracts and were not enforceable at law. Later,

the common-law development of union rights crystallized a judicial tendency to recognize collective agreements as contracts. By provisions of the Labor Management Relations Act of 1947 they were made binding contracts, enforceable through suits by and against unions.

In form, the labor contract continues to be an agreement between employer and individual employee. In substance, it is increasingly, as the scope of collective agreements and social legislation is enlarged, a means of effecting a relationship, the characteristics of which are predetermined by agreement and can be altered subsequently by further agreement.

See also **FACTORY SYSTEM; FACTORY CONSTRUCTION AND PLANNING; INDUSTRIAL ORGANIZATION AND ADMINISTRATION; OFFICE MANAGEMENT; SCIENTIFIC MANAGEMENT; ACCIDENTS, CAUSES AND PREVENTION OF; COLLECTIVE BARGAINING; INDUSTRIAL HYGIENE; VOCATIONAL EDUCATION; VOCATIONAL GUIDANCE; TRADE SCHOOLS; CRISES, ECONOMIC; UNEMPLOYMENT; LABOR LEGISLATION; MINIMUM WAGE; NATIONAL LABOR RELATIONS BOARD; SOCIAL LEGISLATION; UNEMPLOYMENT; EMPLOYERS' ASSOCIATIONS; DEMOCRACY, THE NATURE AND HISTORY OF; EMPLOYEE REPRESENTATION; LABOR OR TRADE UNIONS; MEDIATION; STRIKES AND LOCKOUTS; ARBITRATION, INDUSTRIAL.**

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THOMAS STAMM.

INDUSTRIAL ORGANIZATION AND ADMINISTRATION. In the early years of American business, administrative control was a matter of private or family-owned organizations of the simplest sort. The first large undertakings requiring corporate form and a scheme of formal financing were the toll roads, canal companies, and the railroads. The chief factor which caused an increase in the size of businesses during the half-century 1840-1890 was the invention of machinery. The large-scale operation which machinery and the use of mechan-

ical sources of power suggest has been realized because of the enormous domestic market, the ample capital available, the freedom of the country from tradition and the existence of a spirit of daring. By the decade 1895-1905, these experiments had sufficiently developed the technical aspects of manufacturing that engineers could boldly plan groups of specialized plants under united control. In the meantime, the accountants had learned how to keep untangled the most heterogeneous affairs; and the distributive or marketing machinery was devised for handling the entire domestic market in a single campaign. Since the possible economies from the elimination of competition were very large, there occurred the so-called "trust movement," which resulted in the consolidation of many hundreds of individual plants into a small number of great consolidated corporations. In the process of putting these enterprises together, and of operating them, the art of corporation financing, and its underlying technique of accounting, have achieved a forced growth.

Overlapping this period in part, but operating most intensively from 1910 to 1914, there occurred the movement known as "scientific management." Broadly speaking the purport of this movement is that a group of engineers applied the precise and systematic methods of investigation and calculation recognized in the engineering sciences to the study of shop processes, and that by so doing they uncovered astonishing inefficiencies and were able to recommend a system of functionalization of shop executives and a policy of standardization upon the best methods which systematic study should discover. Scientific management is an effort to apply the scientific method to a certain portion of the shop practice. It met with determined opposition because it did not adequately apply the knowledge and spirit of the times in its handling of the wage earner. A further account of this movement may be found under the heading **SCIENTIFIC MANAGEMENT**. At the present time the interest of business executives in the evolution of new methods centers in "human engineering." There has been an accumulation of knowledge concerning hygiene and public medicine, the causes of fatigue and accidents, and the wastes of the hiring-and-firing methods in vogue, which demands application. It is realized that men should be carefully chosen for their work and given special training for it. Organized labor has enforced the idea upon the public mind that the laborer should have a voice in determining the conditions in which he works. And finally there are new ideals of the "square deal" and of service which are making their way among the more advanced employers.

Departments of Business Administration.

—The ordinary functions of business administration fall into four classes: (1) financing—in charge of the chief officers, working in close relations to the board of directors; (2) manufacturing—in charge of a general manager, or superintendent, directing a corps of foremen in the shops; (3) selling—under the direction of a sales manager, with district agents and salesmen; (4) personnel relations—in charge of an employment manager or superintendent of personnel.

Financial Organization and Management.

—If the inauguration of a business takes the usual course of large modern enterprises, there will first appear upon the scene a promoter

who discovers undeveloped properties or poorly-managed concerns, forms a plan for their development, secures options upon them and puts his project before capitalists. Capital may be represented by a syndicate manager, who acts for a group of banks and large private investors in investigating the projects presented. If a project be found meritorious, its financing will be taken over on conditions which ensure adequate control of the subsequent operations of development. A corporation will then be formed which, under its charter powers, elects officers, enters into contracts, issues securities, receives funds, secures plant and equipment and otherwise prepares to do business.

The liabilities of a business corporation may be briefly listed as bonds, short-term notes, preferred stock, common stock, commercial paper and open accounts. The bonds of manufacturing enterprises (unless the business of certain public utilities be included therewith) should represent but a small fraction of the total capital, for the reason that the earnings of such businesses have, in the past, been subject to violent fluctuations. Preferred stocks are a business man's risk. They may be described as intermediate in security between bonds and common stocks. They will, in many cases, represent the cash and property contributed to the business by the group of interests connected with its organization and development. Common stocks receive dividends only after interest on the bonds and dividends on the preferred stock have been paid. There is no margin of safety to protect them. Their hazard is not so much the correctness of the process of valuing assets as it is the skill of the management in earning income. They are an appropriate investment only for men of means who are intimately associated with industrial management.

The financial authorities of a business are responsible to allot the funds raised from the issue of securities as advantageously as possible to the various requirements. A portion will go into buildings and equipment and other relatively permanent forms. This may be designated as fixed capital. Another portion must be reserved for raw materials, finished stock, pay roll and credit advances to customers. This is circulating capital. Fixed capital loses value slowly as a result of wear and tear. Circulating capital changes its form of investment rapidly. A balance in the bank last week may have been paid out as wages and be now represented by goods in the warehouse. Next week, if the goods are sold, it may take the form of a credit advance to a customer.

As fixed capital is relatively enduring, a large amount of funds should not be put into such a form until it is certain that the enterprise is to be of a permanent nature. Fixed capital may be of various degrees of specialization. The more specialized the form the more difficult it is to sell, and the more its selling price depends upon the hazard of a single set of market conditions. The degree to which it is proper to specialize capital is a function of the conference felt in the soundness of the project. The utilization of fixed capital is a process requiring the continuous supplying of circulating capital. Materials and labor must be provided to support the process of produc-

tion. A plant is valueless when not in motion. To keep it under headway money must be constantly poured into it in amounts which in the average case may equal the total capital of the business annually. It is a somewhat common error of business finance to place an unduly large proportion of the assets in fixed form. The homely caution of Poor Richard may well be remembered, "It is easier to build two chimneys than maintain one in fuel." The financial organization of a private business connects with the general financial machinery of the country through the company's published reports, through the certified public accountant who vouches for the report he signs and through the general banking system. It is further connected by the investment bankers who purchase the securities after investigation and sell them to the investing public, by the stock exchanges which exert some slight control over the probity of the methods of the corporations whose securities they admit to listing privileges, by State commissions which are rapidly taking over the functions of authorizing security issue and by the general machinery of law. See INDUSTRIAL DISTRIBUTION.

Administration of Manufacturing Processes.—The highest authority in a business, on matters pertaining to productive processes, may be known as the general superintendent or works manager. In the initial stages of the business this officer will have the leading influence in determining the location of plants, the layout and character of buildings and the selection of machinery. When preliminary plans result in the construction of a mechanical automaton, and it becomes necessary to add men and materials and to indicate methods of production, in order that the enterprise can become a going concern, the general superintendent will take on a much expanded range of responsibilities. He will be expected to keep the physical equipment and productive processes up to standard and to employ an adequate force of foremen, laborers and skilled men of the various crafts. He will control the progress of work in relation to the demands of the sales department by a schedule and a system of orders, which control all productive labor and the use of material. The design of articles and the accuracy of manufacture is effected through a designing department and a system of inspectors. As a means of improvement he will use time studies and motion studies. The information thus accumulated he will embody in standards, which will be promulgated as the prescribed methods. The ideal is standardization, which is such an effective control of performance that every case conforms to the rule laid down. These prescribed methods will be communicated by general or standing orders and by shop orders. In a business of any size, orders should be written. The standing orders, when gathered together, will compose a "book of rules." The shop orders will be supplemented by instruction cards, to convey precise information as to the materials to be used, the machine or tool to employ, the process to select, the time the task should take, the machine adjustments, etc., etc. A particular instruction card will be prepared in advance for each task, and will be issued from the planning room, for the workman's convenience, each time the job is given out.

The planning room is the chief service aid of the superintendent and the foreman on technical matters. It may, in a typical instance, contain a routing or order-of-work clerk in charge of the planning board, an instruction card clerk, a clerk in charge of time slips and cost records; and it will probably serve also as headquarters for the engineer who calculates the proper speed of machinery, and the time study man who studies manual operations.

From the foregoing statement of duties it can be seen that the general superintendent has a very wide range of responsibilities. To be able to function efficiently, in the face of the enormous evolution of science and technique which has taken place in recent years, he should confine himself to general supervision, entrusting details to a staff of specialists. There has grown up in the best-managed businesses a number of service departments or staff aids for the express purpose of relieving the general superintendent. Such are the tool room, the stores department, the engineering department, the designing and drafting room, the inspection department and the planning room. Usually also the cost department and the employment department will be answerable to him. To a considerable degree the difference in efficiency of manufacturing enterprises depends upon the ability of the superintendent to comprehend the functions of service departments, and his success in organizing about him a staff of specialists who relieve him and his foremen. An executive blockade exists in many businesses because the general superintendent and foremen are overloaded. The remedy is to apply the principal of specialization and division of labor in administration, as it is applied among the craftsmen and common laborers in the shops.

Administration of Personnel Relations.—

Within the last 15 years, the attention of business executives has been increasingly drawn to the problem of employment management, or as it is sometimes called, "human engineering." For years the demand of labor organizations, and the waste and violence of strikes, have made the "labor problem" synonymous with a class contest over the sharing of the product. Recently, the relation between employer and employee has begun to take on a different character. It has been found that a great many things can be done which will benefit both. A field of harmonious policies has opened itself. The labor problem begins to appear to be a matter of the careful selection of men for their work, the provision of comfortable working conditions, the prevention of accidents, the safe-guarding of health, the careful setting of wages on the basis of an honest study of all the facts, including the cost of living, and a variety of activities which develop interest in work, loyalty to a common cause, and the mutual welfare. Experience has proved that these problems can best be handled by having a separate department of the business, which can devote itself to them; and by putting in charge of this department a first-class executive. The movement to install such officers is a resultant of progress in accounting, staff organization, functional foremanizing, vocational guidance, industrial training, the new

wage systems, safety first, hygiene and medical aid, and the use of the committee system of shop management. The functions of the employment department are, for the most part, not new in industry. They are now being gathered together under one authority so that they may be handled in a more expert manner, that they may be harmonized into a consistent policy, and that they may be made the definite responsibility of competent officers. Among the causes which are responsible for the attention now being given to personnel supervision is the extension of cost accounting to the factors which influence labor efficiency. The cost of labor turnover is being calculated. The cost of accidents, of sickness, of absenteeism, of improperly placed men and of strikes is being studied. The employment manager is, in one sense, a labor-cost accountant. The organization of an employment department does not involve an increase in the cost of doing business. On the contrary, it means an economy, by reason of a reduction in the number of persons to be trained, a saving of foremen's energy, a reduction in accidents and a gradual increase in the average skill and experience of employees. Proper employment conditions attract superior workmen, and generate a co-operative spirit; this affects favorably the rate of production, the waste of stock and the quality of output. See LABOR TURN-OVER.

The employment manager is necessary to apply the art of mental testing and vocational guidance in ascertaining the fitness of prospective employees. He best can direct industrial training to provide the talent which the employment records show to be most needed. He knows the process of establishing fair base rates of wages, of working out wage scales, of checking minimum rates against the local cost of living, and of planning simple and specific production bonuses. The employment manager has come in with safety first, because it has been found that three-fourths of the accidents are due to the carelessness or ignorance of the working force. His department works along the lines of hygiene, sanitation, medical aid, canteens and health education, to cut down accidents, reduce fatigue and cure antagonism of mind. Employment supervision represents a movement in the direction of the democratic shop, in which a voice is given to labor in determining the working conditions. It is a means of applying that conception of truth and service which has revolutionized selling and advertising. As the customer is "sold" goods—that is to say is thoroughly convinced and satisfied—so a workman is "sold" his job. The latter has to be satisfied as to the task, the working conditions, the wages and the general policies, before he becomes a genuine employee.

The employment manager is coming in as a new staff man to relieve general executives. Staff or service departments are already familiar in the form of accounting departments, statistical departments and the like. This principle of staff service is now being carried over into the field of human engineering. General executives are demanding well-chosen men, men who are free from accidents and in sound health, men satisfied with their pay, and men

so treated that they form a permanent and contented force, ready to cooperate loyally in the general plans of the enterprise. Of all the standardized agencies a service department can furnish to a general executive, the greatest is a first-class man. In a somewhat analogous way the employment manager represents a step in specializing the work of the foremen. His coming makes the foreman less of a jack of all trades, just as the coming of the tool room, the stock room and the designing department did. When the foreman becomes accustomed to the new system he finds it a great relief. He gets a more even and dependable run of men than he could provide for himself, and he is free to become an expert in shop processes.

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INDUSTRIAL RELATIONS. See **INDUSTRIAL OR LABOR RELATIONS IN THE UNITED STATES.**

INDUSTRIAL RELATIONS COMMISSION. A commission created by act of Congress Aug. 23, 1912, for the purpose of inquiring into the general condition of labor in the principal industries of the United States, including agriculture, and especially in those industries which are carried on in corporate forms; into existing relations between employers and employees; into the effect of industrial conditions on public welfare and into the rights and powers of the community to deal therewith; into conditions of sanitation and safety of employees; into the growth of associations of employers and of wage earners; into the extent and result of methods of collective bargaining; into any methods which have been tried in any state or in foreign countries for maintaining mutually satisfactory relations between employees and employers; into the methods of mediation and conciliation; into the scope, methods and resources of existing bureaus of labor, and into possible ways of increasing their usefulness; into the question of smuggling or other illegal entry of Asiatics into the United States or its insular possessions, and of the methods by which such Asiatics are gaining admission, and to report to Congress recommendations for remedying existing difficulties. The commission consisted of nine members, including three employers of labor, three representatives of labor organizations and three representatives of the public at large. It separated its work into two large divisions, public hearings and research and investigations, and published valuable reports. It expired in August 1915.

INDUSTRIAL REVOLUTION, The. Towards the end of the 18th and the beginning of the 19th century there occurred in England a series of changes in methods of industrial technique and radical alterations in the social and economic organizations. This transformation was characterized by Jérôme Adolphe Blanqui in 1837 as an "industrial revolution," a term which was popularized by Arnold Toynbee in 1880 and has since been used to denote these events. The older idea, given currency by this name, was that a sudden and revolutionary change was wrought in English industry by a dramatic series of new inventions; but more current research has shown that the old system was modified only gradually by a succession of changes which took a long time to work out. Economic history never makes sudden and unanticipated jumps.

Two interesting questions suggest themselves at this point: (1) Why did the Industrial Revolution take place at the end of the 18th century? (2) Why in England?

(1) "Necessity is the mother of invention," says an old proverb, and this suggests the answer to the first question. Productivity in almost every line was limited by ineffective methods and inefficient tools. In agriculture the appliances in use at the time of the Pharaohs were still being employed: grain was sown broadcast, fields were tilled with crude wooden plows, and the harvest was cut with a sickle and threshed with a flail. In the textile industry, the oldest and most important of all, the methods of Penelope in the time of Homer were still used, with the exception that the spinning wheel had been substituted for the distaff and spindle, though this still produced only one thread at a time. In the mineral industry there was promise for the future in some significant changes which were beginning to be made in processes that dated from the time of Tubal-Cain of the Old Testament era. But in transportation great improvements had already been made that were to open up new opportunities. Discussion of this topic must, however, be deferred until the second question is answered.

(2) Why in England? At the end of the 18th century pure research in the physical and chemical sciences had progressed far on the Continent, especially in France and Holland, but the English excelled in the application of scientific knowledge to practical affairs, particularly in industry. There was a general interest in mechanical improvements. Political, social, and legal conditions in England were also favorable to industrial development. Political liberty, freedom from illegal persecution, sanctity of property rights and of contracts, a patent law, religious freedom, and the opportunity of climbing the economic and social ladder created a climate favorable to enterprise. The factors just mentioned were on the side of supply and explain why it was possible for England to take the lead. But the real driving force must be sought on the side of demand, and this brings us back again to the subject of transportation.

The British at this time had the greatest merchant marine in the world and controlled much of the commerce. They possessed, either at home or in the colonies, practically all the raw materials necessary for the development of extensive industries. At home there were wool, coal, and iron, and in the colonies were iron, cotton, dyewoods, lumber, and naval stores. A large actual, and a still larger potential, market existed for the wares that might be produced from these raw materials. This condition was appreciated by shippers and traders and most of all by merchants, who saw that the exploitation of the possible market required improvements in processes of manufacture. All of these materials lent themselves to mass production, lower costs, and larger sales, and strong pressures therefore existed to meet this demand for cheaper methods of production.

Textile Industry.—The first large response occurred in the textile industries. It is not necessary to describe here the remarkable series of inventions in spinning and weaving machines which revolutionized processes, enormously increased output, and also reduced cost per unit. At first these inventions were applied to the woolen industry, but after the American, Eli Whitney, invented the cotton gin (1793), which increased

and cheapened raw cotton, they were used to process this fiber. The manufacture of cotton goods now became the leading industry.

But in order that the new machines might be utilized to the utmost it was necessary that they be driven by some nonhuman power. It cannot be emphasized too strongly that the vital feature of the Industrial Revolution, and the one which constituted a complete break with the past, lay in the substitution of power for human muscle. So long as man was confined to the use of hand tools his powers of production were strongly limited by the number of human hands available for this purpose. But as soon as power-driven machinery was introduced there was no limit placed upon his ability to produce.

This brings us to another step in this complex development—the invention of the steam engine. Thomas Newcomen had invented such a machine in 1705 to pump water out of flooded coal mines. It was while repairing one of these crude machines in 1764 that James Watt invented improvements that foreshadowed the modern steam engine. At first used for pumping and hoisting coal to the surface, the improved machine was soon adapted to the driving of the new textile machinery and to other uses. It must not be supposed, however, that the modern steam engine sprang at once into being, for a whole series of other inventions were necessary to improve it. Cylinders bored by hand were distressingly irregular until John Wilkinson invented his cannon-boring machine in 1774 and Henry Maudslay his slide rest in 1794. These produced cylinders so accurately bored that the pistons would fit in them without waste of steam. The modern machine was now realized.

Iron and Steel Industries.—The second industry which was transformed by inventive genius was the production of iron and steel, which was now badly needed for the construction of the new machines. The smelting industry was one of the oldest in England, but it suffered from the exhaustion of the forests which had provided fuel (charcoal). Experiments in the use of coal as fuel were carried on during most of the 18th century and by its end the smelting of iron by coal or coke instead of by charcoal had been almost universally adopted. But this was only the first step in a complex metallurgical process. The pig iron must now be converted into steel. Further inventions made this possible, with improvements being made in the blast, the substitution of rollers for hammers in shaping the malleable iron or steel, and in appliances for handling heavy castings. It was now possible to make strong and powerful machines, for which there was an ever-increasing demand.

Economic and Social Aspects.—The final stage in the Industrial Revolution was a momentous one. Until the new inventions revolutionized methods of production, industry had been carried on under the domestic system, in which artisans conducted their crafts on a small scale in their homes. But there gradually emerged enterprisers who gathered the domestic workers together in workshops, where they provided the tools formerly owned by the workers. When the new machines appeared, which were too expensive for the artisans to buy, it was but a short step for the enterprisers who possessed sufficient capital to organize production under the factory system. Thus was born a new system of capitalistic organization which has since characterized modern industry.

The factory system brought far-reaching

changes. In the first place, since they controlled the new machines, the capitalists were able to dominate all the processes of production, the place of working, the scale of wages, and the kind of workers. Improvements in agriculture, due in part to improved tools and in part to enclosure of the land, produced a larger supply of food and released many agricultural laborers from the land. This supply, together with child labor which could be used to tend machines, depressed wages and raised profits. The capitalists were now in the saddle. A sharp schism developed between capitalistic enterprisers and wageworkers, with the latter group becoming increasingly dependent upon the former for employment and the seeds being sown for a bitter struggle between capital and labor which continued for another century. (See *FACTORY SYSTEM*.)

But the results of the factory system were not all bad. Although the wealth was very unequally distributed and wealth and poverty moved hand in hand, a great increase in productivity nevertheless enormously augmented the wealth and power of the nation. At the same time industry became increasingly integrated and large-scale. It was also more and more complex and interdependent. The essential feature, however, is the ascendancy of the capitalistic organization of industry.

It is not surprising to find that economic theory accommodated itself to the new conditions. The classical economists were the apostles of *laissez faire*, of free trade, and of noninterference with trade and industry. Government control was reduced to a minimum. Even legislation for the protection of child labor and of exploited workers could not make headway against the massive pressure groups that thwarted every effort at reform. The Act of 1819 is often cited as the first factory labor act, but it covered only cotton mills. The Act of 1833 was the first really effective act, covering all textile mills, setting the minimum age for child workers at nine years, and providing for inspection and school attendance.

One conclusion that may be drawn from the events of the Industrial Revolution is that its achievements were the result of the cumulative efforts of a great many individuals, with each building upon the success of his predecessor. Today improvements in technical processes are usually the result of teamwork, probably financed and directed by some great corporation. The success of the early pioneers, working alone, may well command our admiration.

A final word should be said. The Industrial Revolution, which transformed the social and economic organization of England, is still going on. It has spread geographically to the ends of the earth. The Age of Steam has given way to the Age of Electricity, and there is a future promise of an Age of Atomic Power for peaceful purposes.

See also CANADA—12. *Industrial Development*; ECONOMICS; EIGHTEENTH CENTURY; FACTORY SYSTEM; GREAT BRITAIN—4. *Economic History*; GREAT BRITAIN—12. *Education* (The 19th and Earlier 20th Centuries); GREAT BRITAIN—6. *Labor* (Trade Union History; Labor Legislation); LABOR—Labor and the Economists; NINETEENTH CENTURY; UNITED STATES—23. *Industry*.

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INDUSTRIAL SCHOOLS. See **TRADE SCHOOLS**.

INDUSTRIAL TERMS. Following is a glossary of common terms used in industry. Terms not appearing here may be found in separate articles under their own headings or in some of the following: **AERONAUTICS**—11. *Aeronautics Glossary*; **ATOMIC AND NUCLEAR TERMS**; **AUTOMOBILE GLOSSARY**; **BANKS AND FINANCE**—29. *Glossary of Terms*; **CHEMISTRY**—4. *Chemical Glossary*; **COMMERCIAL TERMS**; **ELECTRICAL TERMS**; **ENGINEERING TERMS**; **FOUNDRY AND FORGE SHOP TERMS**; **GRAPHIC ARTS**—*Glossary of Graphic Arts Terms*; **HOSIERY INDUSTRY AND HOSE—Hosiery Terms**; **LABOR TERMS**; **LEATHER AND SHOE TRADE TECHNICAL TERMS**; **SHIPPING AND SHIPBUILDING TERMS**; **STEEL**—6. *Glossary of Steelmaking Terms*; **VALVE TERMS**; **WORKSHOP TERMS**.

In this glossary, cross references in *italics* are to other headings in the glossary; other cross references are to separate articles.

Acid-test Ratio.—A financial analysis ratio indicating a firm's relative ability to meet its current obligations. It is determined by dividing liquid assets (cash or its equivalent) by liabilities that must be met with cash in the near future.

Adder.—In color television, a device that integrates three individual color signals into a brightness signal for transmission.

Adit.—See *Drift*.

Advanced Gallery.—The small opening cut in front of the main shaft when excavating a tunnel; the area in which the workers are actually cutting on the tunnel face.

Afterbay.—The water outlet of a water-operated turbine power plant.

Afterdamp.—A gas, usually consisting chiefly of carbon dioxide and nitrogen, which remains in a mine after a mine fire or explosion.

Aging.—(1) Subjecting electron tubes to various current loads in order to stabilize their operating characteristics. (2) Storing various food products under controlled conditions to improve their flavor. (3) In accounting terminology, determining how long various debtor or creditor accounts have been left standing on the books.

All-sliming.—Crushing ore in a mill into fine particles. **Allen-O'Hare Furnace.**—A horizontal double hearth furnace for calcinating sulphide ores.

Almond Furnace.—A furnace in which litharge (lead monoxide) slags left from refining silver are reduced to lead.

Alpha Brass.—A copper-zinc alloy with a copper content of above 64 per cent.

Annular Bore.—Tool with a hollow cylindrical bit used to cut cores for earth samples (see *CORE*).

Anode Copper.—Crude copper plates cast at a converter and used as anodes (see *ANODE*) in further electrolytic refining.

Anodize.—To use a metal as an anode (q.v.) in a chemical bath in order to give it a desired coating.

Anticline.—See *ANTICLINE*; *FOLDS*.

Arch.—In mining, a portion of a lode left standing because it is too poor to work or is needed as a support.

Archimedean Screw.—See *ARCHIMEDES' SCREW*.

Arents' Tap.—Device for drawing off molten lead from the interior of a shaft furnace without disturbing the furnace.

Argil.—Potter's clay.

Babbitt Metal.—See *BABBITT METAL*; *ANTIFRICTION METALS*.

Back.—(1) In metal mining, the portion of the lode that lies between a level and the one next above it, but has to be worked from below. (2) In coal mining, the inner end of a heading where work is being conducted. (3) In the leather trade, the thickest and best hides.

Back Slope.—Supporting timbers across the top of a

mine shaft, usually fitted into notches in rock.

Back Tender.—A man who ladles paint pastes into color boxes for textile printing.

Bag Molding.—The process of shaping precut sections of glass mat over cloth on a mold and applying molding resin, heat, and pressure to bond the materials. The technique is usually employed for molding large plastic shapes.

Bagasse.—See *BAGASSE*.

Baking Out.—The process of drying graphite and phosphor coatings on electron tubes by subjecting them to heat which simultaneously anneals the bulbs.

Band.—A strip of minerals interstratified with coal.

Barff's Process.—A process for protecting iron from rusting by oxidizing it with superheated steam.

Barrel Work.—Pieces of native copper too small to be handled as mass copper, but large enough to be shipped in barrels.

Base Box.—A standard unit of measure in the tin can industry, equal to 31,360 square inches.

Basing Point.—Some point, usually an industrial or railroad center, from which freight charges to customers are figured. It is frequently not the place of production, and the item shipped does not necessarily pass through that point.

Basque.—A lining for furnaces or crucibles.

Bastard Cut.—Very coarse spacing of teeth on a file.

Bat.—In ceramics, a flattened circular piece of clay ready for mold-spinning of a plate or saucer.

Bating.—Soaking operation to loosen scud and plumping from leather, rendering it soft and fit for tanning.

Batting Block.—In ceramics, the plaster slab on which clay is beaten before forming.

Beading.—Process by which a thin lip of metal is curled over on itself to increase its strength and eliminate its sharp edge.

Beater.—In papermaking, a large kettle in which water and caustic soda are added to wood pulp, also used for mixing in special finishing materials for specific papers.

Beaumontage.—The filling material used to stop small holes in wood or metalwork. For wood it is made of varnish thickened with chalk and resin; for iron, of iron filings mixed with sal ammoniac.

Beehive Oven.—See *COKE*.

Beetle.—A heavy wooden mallet used to drive wedges.

Beneficiation.—The process of increasing the concentration of metal in low-grade ores before smelting. See *IRON*—4. *Pig Iron*; *METALLURGY*—4. *Extractive Metallurgy*.

Beta-ray Gage.—A device for measuring the thickness of a material by measuring the amount and intensity of beta rays passed through it.

Binder.—A material used to hold particles of sand together in the desired shape during sand molding.

Bittern.—The liquor remaining in salt processing after the salt (sodium chloride) has crystallized out. See also *SALT*.

Blackjack.—Sphalerite (zinc blende or sulphide of zinc).

Blanché Copper.—A copper-arsenic alloy.

Blast Gate.—A device for controlling the pressure on gas turbine blades by releasing gas from the nozzle box to the free atmosphere.

Bleeding.—(1) In textile printing, the spreading of dye on cloth. (2) In publishing, printing beyond the margin or to the edge of a page. See also *GRAPHIC ARTS—Glossary of Graphic Arts Terms* (Bleed).

Blind Screening.—A pharmaceutical research technique of exposing disease-causing agents almost randomly to various compounds to see whether the compound eliminates the agent.

Blooming.—Rolling an ingot into a rough shape with a square or rectangular cross section having an area of 36 square inches or more. See also *ROLLING MILLS*.

Blow.—(1) One complete cycle of removing impurities from steel by the Bessemer process. (2) Letting air out of a working chamber so that a caisson can drop into place.

Blue-short Iron.—Wrought iron made brittle by being worked at blue heat.

Blunger.—A mixer for clays in earthenware manufacture.

Board Hammer.—A small gravity-operated drop forge lifted by rollers operating against boards.

Body.—The mixture of clay and powdered rock from which brick and tile are made.

Bonanza.—A body or pocket of rich ore.

Boom.—A long beam or spar projecting from a derrick or similar device used for lifting or moving.

Boring.—See *BORING* and *BORING MACHINES*.

Borsella.—A device used to stretch or contract glass during its manufacture.

Bottom Hole Contribution.—Amount paid to an oil driller when he reaches a certain depth regardless of whether the well produces oil.

Bow Tie.—A type of antenna, named from its shape, used for transmitting or receiving television signals.

Brood.—A mining term applied to all heterogeneous mixtures found with copper or tin ore.

- Bubble Tower.**—A tower used for fractional distillation of oil or other complex chemical substances.
- Bulling Bar.**—In mining, the bar used to ram clay fillings into open cracks before blasting.
- Bumping.**—(1) Flattening the side seam of a cylindrical can after edges are hooked. (2) The practice by which a senior laborer replaces a junior laborer at another job during a cutback in the production force.
- Bundle.**—(1) In papermaking, 2 reams of printing or brown paper. (2) In spinning, 20 hands, or 6,000 yards of linen yarn.
- Burden.**—A term commonly applied to the overhead costs of an operation. Burden rate refers to the ratio used in allocating burden costs to units of production, such as dollars per direct labor dollar, or dollars per square foot of space used.
- Burner.**—A kiln fireman.
- Butt Weld.**—Joining two pieces of metal by placing the surfaces to be welded close to each other, then building up the weld between them.
- Cable-tool Drilling.**—A method of drilling wells by pounding a hole into the ground with a heavy bit attached to a cable.
- Cade.**—A term of measurement in the fishing trade, denoting either 500 herrings, or 1,000 sprats.
- Cambering.**—(1) Placing curvature in a rail or beam to compensate for unequal cooling of head and base so that rail will be straight when cool or when under dead-load conditions. (2) Setting wheels of an automobile closer together at bottom than top.
- Camelback.**—An uncured compound of rubber, mostly reclaimed, used for retreading or recapping tires.
- Candle.**—To determine the internal characteristics of translucent materials by passing a light through them.
- Carboy.**—A large glass bottle used for transporting acids.
- Carding.**—In textiles, preparing fibers for spinning. See also **CARDING; TEXTILE MACHINERY.**
- Carrier.**—(1) The basic signal frequency upon which information is mounted in point-to-point or broadcast electrical transmission. (2) A chemical agent or catalyst which enables the transfer of some element or group from one compound to another. (3) One who transports on behalf of another.
- Cat Cracking.**—Catalytic cracking (see **Cracking**).
- Catalyst.**—A chemical which assists or controls a chemical reaction without being one of the agents in the reaction.
- Chassis.**—The metal framework to which mechanical or electronic components are attached.
- Checker Chamber.**—The heat-exchanging brick chamber through which hot gases pass in open-hearth or blast furnaces. The name is derived from the checkerboard pattern of holes through which air passes.
- Cheek.**—The center part of a three-part sand mold.
- Choker.**—A short length of wire rope used in logging.
- Christmas Tree.**—The system of valves and controls used at the ground surface to control the flow of oil from a producing well.
- Chuck Machine.**—A semiautomatic lathe (usually with multiple spindles) which must be fed each piece individually; that is, it does not have a provision for automatic throughput of bar stock.
- Churn Drill.**—A mobile drill for digging wells. Cutting action is created by repeated dropping of a cable-lifted ream. The ram bit pulverizes rock and soil as it strikes.
- Cloud Point.**—The temperature at which paraffin wax and other solid substances begin to crystallize out of petroleum vapor as it is cooled.
- Cobble.**—A piece of steel so twisted or bent that it cannot be rolled.
- Cockle.**—(1) In porcelain making, a large stove used to dry the biscuit ware after glazing, preparatory to burning. (2) The kiln used for drying hops.
- Coil.**—In electricity, a loop or loops of insulated wire through which current is passed. See also **INDUCTION COIL.**
- Coke Tower.**—A coke-filled condensing tower used in the manufacture of hydrochloric acid. Water is sprayed down from the top to mix with rising hydrochloric acid gas.
- Cold Mix.**—A mixture of asphalt or tar that can be laid without extensive heating.
- Cold-short Iron.**—Iron that is weak and brittle when cold because of the presence of phosphorus.
- Collier.**—(1) A vessel for carrying coal or other bulk commodities. (2) A worker in a coal field.
- Collodion.**—An insulating material used to bind electrical coil windings.
- Combing.**—See **TEXTILE MACHINERY.**
- Common Return.**—A single wire or pipe which serves as a return path for electricity or fluid from several output systems.
- Compression Molding.**—Shaping plastic materials in dies by simultaneous application of heat and pressure.
- Condensate Crude.**—A crude oil which gives a high yield of low-boiling-point condensates.
- Cone.**—In textiles, a cylindrical spool of yarn or thread usually wound from a skein.
- Cope.**—The upper half of a mold used in sand casting.
- Core.**—(1) The baked sand mold used to form an internal shape in a sand casting. (2) The cylindrical sample of subsurface geological formations obtained by drilling with a hollow drill.
- Cottle.**—A flexible form used to cast clay to the approximate form desired.
- Count.**—In textiles, (1) the relative diameter of threads as measured by the weight of a stated length. Single-thread counts in cotton are the number of hanks of 840 yards in 1 pound; that is, a 20-cotton thread is 20 hanks to the pound. In worsted, the basis is 560 yards to the pound. In wool, it is the number of 1-yard skeins in 1 dram. (2) The number of picks or threads to the inch in a woven fabric, as 60-count.
- Counterbore.**—To bore a shallow cylindrical recess of larger diameter at the surface end of a hole. The counterbore usually serves as a seat for a bolt head or washer.
- Countersink.**—To cut away material at the surface end of a hole so that the head of a flathead screw would be flush with the surface.
- Cracker Mill.**—A mill that breaks up rag stock in rubber-shoe manufacture.
- Cracking.**—The process of breaking a complex organic molecule into more elementary parts by means of heat and pressure (thermal cracking) or with the assistance of a catalyst (catalytic cracking). The elementary parts are then used to build new and different molecules. See **CRACKING PETROLEUM.**
- Cradling.**—In construction, placing cables of a suspension bridge closer at the center of the bridge than at the tower ends.
- Crazing.**—(1) Fine cracks that extend over the surface of a molded plastic or penetrate through a thin section of it. (2) In ceramics, when the glaze separates from the body and forms blisters.
- Creel.**—A device onto which yarn on bobbins is placed before weaving.
- Cropping.**—Removing metal from the bottoms and tops of ingots after semifinishing.
- Crosshauling.**—The shipment of goods by producers into each other's territories before the demand in their own territories is filled, the extra shipping caused by greater area competition under the basing-point system.
- Cull.**—In plastic molding, the excess material in the molding machine's transfer chamber after the molding cycle is complete.
- Cullet.**—In glass manufacture, the clean waste and broken glass from previous meltings and castings which is added to a raw batch to initiate the fusion.
- Current Ratio.**—A ratio indicating a firm's relative ability to meet its current obligations. It is determined by dividing current assets by current liabilities.
- Cutbacks.**—Petroleum residues fluxed with distillates.
- Cuts.**—Crude distillates drawn off from an oil-fractionating tower.
- Dabbing.**—In stoneworking, the process by which the surface of the shaped stone is covered with small pecked indentations.
- Dag.**—A graphite coating placed on the inside of a cathode-ray-tube bulb to form the high-voltage anode.
- Damask.**—Surface imperfections on polished steel caused by corrosion.
- Dandy Roll.**—In papermaking, the wire-gauze cylinder beneath which the web of water pulp is passed to drain it partially of water and impress the watermark.
- Dap.**—To notch a timber.
- Dead Load.**—A steady nonvariable weight acting on a structure.
- Decoder.**—In a color-television electronics system, a device to break up the color information signal into red, blue, and green signals.
- Defecation.**—The process of removing impurities from fluids or materials.
- Dehydrogenation.**—The process of cracking more complex molecules and forming new molecules by removing hydrogen.
- Demurrage.**—A charge for holding a railroad car beyond specified time limits.
- Den.**—A storage bin used for bulk items.
- Depletion.**—(1) The actual exhaustion of mineral resources or (2) an accounting charge that amortizes the cost of a deposit against revenues derived from selling the minerals.
- Depreciation.**—See **ACCOUNTING.**
- Desizing.**—Removing the sizing from cloth before finishing operations. This usually involves dipping the cloth in solvent and washing it in clear water.
- Detail.**—A small part of a construction or the drawing of a particular part.
- Development.**—A stage in scientific research in which known principles are applied to the solution of a par-

- tical problem. Development includes the construction or synthesis of experimental (prototype) devices or materials.
- Digester.**—In paper processing, a large refining unit where beaten pulp is cooked.
- Dip Needle.**—In prospecting, a magnetic needle that swings in the vertical plane and dips toward certain mineral deposits.
- Dip Soldering.**—Soldering electrical connections by lowering the chassis, with components mechanically attached, into a shallow tray of hot solder. The solder flows up the crimped leads of the components by capillary action.
- Diplexer.**—A device for integrating two signals of different frequencies to be transmitted from the same antenna.
- Dissociation.**—See DISSOCIATION.
- Doctor.**—The sharp metal scraper used to remove paper from the Yankee dryer in the first stages of paper processing.
- Dolly.**—(1) A soft polishing mop rotated at high speed for putting the final surface on metalwork to be plated. (2) In mining, a heavy tool, sometimes of wood, for crushing soft materials. (3) A rack or frame mounted on small wheels and used to move heavy loads.
- Dose.**—A special charge of materials inserted into a blast furnace to correct its faulty operation.
- Drafting.**—Straightening the fibers in a textile sliver and elongating it for spinning.
- Draw Spike.**—A pointed steel rod with a loop on one end, used to remove the wood pattern from a sand mold.
- Draw Works.**—The portion of oil-drilling apparatus used to raise and lower drill pipe and sometimes also to operate the rotary table that drives the drill.
- Drawing-in.**—In textiles, threading warp ends through drop wires, heddle eyes of the harness, and dents in the reed prior to weaving fabric on a loom.
- Drift.**—A nearly horizontal passageway into a mine.
- Drifting.**—Mining along a shaft following an ore vein.
- Drill String.**—In oil drilling, the hollow drill shaft extending from the surface to the rotary bit.
- Dross.**—Metal oxides in metal or alloys, particularly in the manufacture of copper and brass products.
- Dry Hole.**—An oil well dug to a specified depth without striking oil.
- Dummy.**—In plumbing, a wooden rod having a lump of lead at the end, used for ramming out dents in lead pipe.
- Duplexing.**—Using molten steel to charge an open-hearth furnace.
- Electrical Logging.**—Determining the oil or salt-water content of formations drilled through, by measuring their electrical resistivity.
- Elevation.**—A drawing or view of the vertical dimensions (side or front) of an object.
- Encoder.**—A device that combines color-hue and saturation information for transmission in color-television systems.
- Entrance Cone.**—The part of a wind tunnel from which air is drawn into the experimental chamber.
- Envelope.**—The glass bulb used in making electron tubes.
- Facing.**—(1) In construction, the use of a special aggregate in concrete, next to the forms, to give a desired finish. (2) Cutting on a lathe in a direction perpendicular to the longitudinal axis of the lathe.
- Fat Coal.**—Coal containing an excess of oily material.
- Fat-liquoring.**—Restoring fatty oils to chrome-tanned leather.
- Fat Sand.**—Sand with a high percentage of clay.
- Fidelity.**—In electronics, the degree of accuracy with which the output of a system reproduces the signal that is impressed on its input.
- Filler.**—(1) Material such as fiber glass or cellulose used to extend or improve the quality of a plastic when molded. (2) Any relatively fine material used between the particles of a coarser aggregate.
- Fining.**—Removing gas bubbles from molten glass by keeping the glass at a high heat.
- Fish Eye.**—In plastic molding, a small globular imperfection in the plastic material.
- Flash.**—A box-shaped container without a top or bottom used in the preparation of sand molds.
- Flash Point.**—The temperature at which a material vaporizes and can be made to burn by applying a small flame.
- Flattening.**—In painting, laying a coat of paint with a dead surface.
- Fleshing.**—The process of removing adipose material from hides.
- Floating.**—The process of smoothing the surface of poured concrete slabs.
- Flocculator.**—A device for bringing together two or more liquids to form a liquid precipitate of a third substance.
- Flour.**—Finely ground rock or mineral substances.
- Flyback.**—The rapid return of an electron beam in a cathode-ray tube after its horizontal sweep.
- Flying Conveyor.**—An overhead conveyor used to move parts from one operation to another and for temporary storage in a production-line operation.
- Forge.**—See FORGE, FORGING, AND FORGING MACHINES.
- Fork Truck.**—A small truck with prongs for lifting packages or pallets, used to move materials in warehouses or industrial plants.
- Fourdrinier Wire.**—The wire screen onto which pulp flows at the beginning of paper processing. Water is drawn through the screen by gravity and suction, leaving the fibers on top to knit together and form paper.
- Fractionating (Fractional Distillation).**—Removing the individual chemicals in a heterogeneous mixture by boiling each off at a different temperature and then condensing it.
- Frame.**—(1) A single complete sweep of the face of a cathode-ray tube. (2) In moving pictures, one of the series of pictures on a film.
- Free Volume.**—In the electrical lattice of a material or liquid, the holes which allow comparatively free movement of molecules.
- Frog.**—A kind of track intersection that allows flanged wheels rolling on one rail to cross another.
- Fuller.**—A round-edged blacksmith's tool used for spreading hot metal.
- Fuller's Earth.**—A high-water-content clay. See FULLER'S EARTH.
- Fulling.**—A textile-finishing process that shrinks fabric to give it a compact look and feel. Also known as felting or milling.
- Fundamental Research.**—The search for knowledge in a particular scientific area without regard to specific ultimate applications of the knowledge.
- Furnisher Brush.**—In textile operations, a device to feed color to printing rollers.
- Gad.**—A metal spike used to break up ore.
- Gang.**—Several cutting tools set up to make a variety of cuts simultaneously, as in gang milling or gang drilling.
- Gas Oil.**—A distillate from which diesel and light heating oils are made.
- Gathering.**—In glassmaking, the method of coiling the molten glass on the end of an iron tube preparatory to the work of blowing.
- Getter.**—A barium device placed in vacuum tubes to remove undesired gases. Once the tube is evacuated, the getter is heated to red heat (flashed) by high-frequency bombardment. The vaporized barium condenses and attracts undesirable gases.
- Gin Pole.**—A vertical guyed pole used with a block and tackle for lifting heavy weights.
- Glory Hole.**—(1) A small furnace used to reheat glass during its manufacture. (2) An open pit from which ore has been removed.
- Gob.**—A measured amount or lump of plastic or molten glass, usually the exact amount needed for a mold.
- Grab Set (False Set).**—Concrete rapidly developing a hard surface before its internal portions have solidified.
- Gravity Meters.**—Devices used in oil and ore prospecting to detect minute changes in gravity due to heavy rock structures near the surface.
- Gray Goods.**—Cotton cloth before it goes through finishing operations. Cloth sold in this form is "in the gray" (or greige).
- Gray Iron.**—The ordinary commercial iron often used in casting. It has very low tensile strength and little ductility. See also IRON—3. *Cast Iron; 11. Iron and Steel, Metallurgy of.*
- Grid.**—A fine wire screen that retards or encourages electron flow in a vacuum tube.
- Grout.**—(1) To fill small joints of masonry with a sandy cement. (2) The cement itself.
- Gun Metal.**—An alloy of copper and tin once commonly used to make cannons. Now any of various alloys used to imitate this metal when black or tarnished.
- Gusset Plates.**—Plates used in metal construction to join or strengthen members.
- Gyratory Crusher.**—A rock crusher which uses a large, vertical, conical shell driven within an enclosure by eccentrics.
- Harness.**—(1) In electrical manufacture, a large number of individually insulated wires worked together into a cable to make electrical contact between a number of points in the circuit. (2) The apparatus in a loom that shifts the warp threads alternately to form the shed.
- Head.**—(1) The pressure exerted by a fluid. (2) The distance from any lower plane up to the surface of a body of water.
- Headframe.**—The framework at the head of a mining shaft, used to raise and lower men and materials from and into the mine.
- Heat.**—A complete cycle of charging, melting, and pouring off metal in a furnace.
- Heterodyne.**—In radio, the action of two alternating

- currents of different frequencies in the same circuit. Being alternately additive and subtractive, they produce two-beat frequencies that are the sum of and difference between the two original frequencies.
- Hole Current.**—The electric current in a semiconductor. The name derives from the apparent holes in the electron distribution of a semiconductor.
- Horizontal Integration.**—The process in which a company acquires other institutions at the same distributive level, that is, a fabricator acquiring another fabricator.
- Horn.**—In electronics, a device to transmit an electromagnetic or acoustical pattern in a desired direction without the dispersion of signals common to other antennas.
- Hot Car.**—The vehicle that carries coke from the by-product oven to quenching and to storage near blast furnaces.
- Hot-top Ingot.**—An ingot cast in a mold with top extended to provide extra metal as the ingot cools and thus prevent a cooling cavity from forming in the top of the ingot proper.
- Housing.**—A structure encasing a part or subassembly.
- I Beam.**—A girder with an I-shaped cross section.
- Idler.**—A gear that neither drives nor is driven by a shaft to do useful work. It is used to make the final gear in a train rotate in the proper direction.
- Ignitron.**—An electron tube of the mercury-arc type using a mercury pool as a cathode and special igniter rod(s) as the anode. See also **ELECTRONICS—Diodes.**
- Image Orthicon.**—The tube commonly used as a pickup tube in television cameras. See also **TELEVISION—2. Engineering (Pickup Tubes).**
- Imbibition.**—In color photography, the transfer of a dye from a matrix to a prepared support.
- Impact Mill.**—A type of grinding machine that reduces material by pounding it with rows of loosely hinged hammers.
- Implosion.**—The inward shatter of a glass bulb under vacuum.
- Incongruent Compound.**—A compound that dissociates when melted and forms a new crystalline phase different in composition from the original material.
- Indirect Cost.**—The semivariable element in overhead cost. Indirect costs usually vary with production but not in direct proportion to it.
- Induction Field.**—The magnetic field set up around a conductor when a current passes through it.
- Induction Heating.**—Heating by inducing a current in a dielectric material that dissipates energy. See also **ELECTRIC FURNACES—Induction Furnaces.**
- Infra-audible Sound.**—Sound having a frequency below the lower pitch limit.
- Initial Set.**—Concrete or similar plastic materials when they first begin to crystallize and stiffen perceptibly. The initial set of a material may enable it to support its own weight but not added loads, which are put on only after final setting has hardened the material throughout.
- Insert.**—A metal device embedded in concrete, but exposed at the surface for use as a connection.
- Interlace.**—The pattern made by a television cathode-ray tube electron beam scanning alternate lines as it moves vertically down the screen, then scanning a second time to cover the alternate lines skipped the first time.
- Intermediate Frequency.**—In electronics, the frequency of a mixer output signal that is equal to the difference between the frequency of the antenna signal and the frequency of a local oscillator.
- Inverse Voltage.**—Counterelectromotive force.
- Inversion.**—The alteration of dextrorotatory cane sugar into levorotatory fruit sugar through the action of dilute acid. The product is termed "invert sugar."
- Inverter.**—A device for converting alternating current to direct current.
- Investment Casting.**—A process of casting metal in a ceramic or plaster-of-paris mold. The mold is made from wax patterns removed from the mold or investment by heat. The process holds extremely fine tolerances and surface finishes.
- Ion Burn.**—A discoloration of the face of a cathode-ray tube caused by bombardment of heavy negative ions.
- Izod Test.**—A pendulum type of impact test.
- J Box.**—In textiles, a bin used during the desizing operation. The J shape of the bin allows slow treatment of the cloth, along with a rapid yardage input and output.
- Jack Star.**—A hard metal piece used as an abrasive in tumbling.
- Jacking.**—A method used in installing conduits. A hole slightly larger than the pipe size is dug at the head of the pipe, which is then forced into the hole by horizontal jacks.
- Japanning.**—A process for covering sheet metal with a thick baked-on coat of oil or varnish.
- Jedding Ax.**—A kind of stonemason's ax whose head has one flat face and a pointed back or peen.
- Jenny Winch.**—A small derrick usually made of wood and operated by a small motor or by hand.
- Jetting.**—Sinking piles by digging out the earth beneath them with a water jet.
- Joint Costs.**—Costs common to the production of two or more end products, usually indirect and not identifiable as specific costs of any single end product.
- Joist.**—In construction, a beam to which a floor, wall, or ceiling is attached.
- Jumper.**—A wire used to bring current directly from a power source to a unit which usually has a switch or other component between it and the source.
- Jungle.**—The section of the production line where auto bodies are subassembled, so called because of the maze created by spot-welding wires and supports.
- Kelly.**—The uppermost link in the hollow shaft extending from the surface of the ground to the rotary bit used for oil drilling. It is square shaped to fit into the driving mechanism that turns the rotary bit.
- Kerf.**—The narrow slot made by the saw blade in sawing lumber.
- Kerogen.**—Oil shale.
- Keuper.**—Copper-bearing shale.
- Kidney Ore.**—Hematite occurring in compact masses shaped like kidneys.
- Kier Boiling.**—Boiling cloth in a weak alkaline solution under pressure for the purpose of removing grease, oil, or other natural impurities from it before finishing.
- Killed Steel.**—Steel deoxidized so that there will be little evolution of dissolved gases during cooling and hence few blowholes.
- Kinescope.**—A television-receiver cathode-ray tube.
- King Truss.**—A truss with a vertical post at its center.
- Kip.**—A unit (1,000 pounds) used in measuring stress.
- Klystron.**—A velocity-modulated electron tube used in high-frequency circuits. See also **ELECTRONICS—Microwave Electronics.**
- Lag Screw.**—A heavy screw with a square bolthead.
- Laid Up.**—Indicating that a dolly bar is tight against the rivet head prior to riveting.
- Lap.**—A flat compressed sheet of cotton as it comes from pickers.
- Lath.**—A structural material used as a base for plaster or stucco.
- Laundry.**—A trough or channel for conducting molten metal or a mixture of tailings and water.
- Lay.**—In textiles, the number of layers of material spread out and piled on top of each other for simultaneous cutting.
- Laying Out.**—Sewing together pieces of gray cloth into long continuous pieces for finishing.
- Leach.**—To dissolve materials out of a heterogeneous mix by slow action of a fluid.
- Lehr (Leer).**—A continuous oven for cooling glassware slowly.
- Lewis.**—A dovetailed steel instrument inserted into a corresponding mortise and used in lifting stone.
- Lift.**—In quarrying, a plane approximately parallel to the quarry floor along which quarry stone is usually split.
- Lime Glass.**—A glass that derives its amber color from lime in the processing batch.
- Linear Programming.**—A mathematical problem-solving technique for finding an optimum solution to a mathematical model involving many possible input and output variables.
- Link.**—In surveying, a unit of measurement (7.92 inches) derived from the link in a surveyor's chain.
- Lintel.**—In construction, a horizontal beam carrying a load across a wall opening.
- Live Load.**—A noncontinuous or variable stress which outside factors induce on a mechanical member or system.
- Load.**—(1) In electronics, the element to which transmitted signal power is delivered. (2) In mechanical design, a stress acting on a member or system.
- Lock Nut.**—A thin auxiliary nut screwed down upon an ordinary nut to prevent its loosening.
- Loss Factor.**—A measure of the rate at which heat is generated in a dielectric.
- Lost-wax Process.**—A casting method using a wax pattern that is subsequently melted from the mold, leaving a cavity with all the details of the pattern.
- Lug.**—A projection for holding or supporting something.
- Lump Lime.**—Quicklime as it comes from the kiln.
- Lute.**—(1) A fire clay mixture used to seal cracks in furnaces. (2) To seal with clay or other plaster materials.
- Macadam.**—A road surfacing. See **MACADAM.**
- Magna.**—See **MASCALITE.**
- Magnetic Head.**—A transducer for converting magnetic to electrical variations.
- Magnetic Lens.**—An arrangement of coils and magnetic components for focusing an electron beam.
- Magnetron.**—A kind of vacuum tube often used in high frequency applications. The magnetron functions un-

- der the joint action of an externally applied magnetic field and the field between its own anode and cathode. See also **ELECTRONICS—Microwave Electronics**.
- Maltha**.—A highly viscous asphalt petroleum that hardens quickly when exposed to air.
- Manganin**.—An alloy of copper, nickel, and manganese, used for electrical resistors.
- Maser (Microwave Amplification by Stimulated Emission of Radiation)**.—A device that reinforces radiations emitted by molecules and sets up strong controlled microwave oscillations. The result is an extremely narrow-range, stable frequency emission for use in electronic controls or amplifiers.
- Massacuite**.—The mass of sugar sirup and crystals obtained in sugar processing after crystallization.
- Matrix**.—The mixture of binding material and/or aggregate by which a larger aggregate is held in place.
- Memory**.—That section of a computer which holds information for later use. See also **COMPUTERS—2. Digital Computers, 4. History**.
- Memory Core**.—A small magnetic device in the buffer unit for the memory system of a computer. It stores electrical information as a single unit charge.
- Micarta**.—An electrical insulating material made of mica and paper.
- Mode**.—The actual mineral composition of a rock, as opposed to its theoretical composition.
- Modulation**.—The process by which one wave (the carrier) is varied in accordance with another (the modulating wave). In wireless transmission, modulation can be obtained by varying the carrier amplitude (AM), the carrier frequency (FM), or the carrier phase.
- Module**.—(1) In electronics or mechanics, a complete component unit of a total system which can be built or switched into the system as needed. (2) In hydraulics, a device for delivering or measuring a definite quantity of fluid.
- Molecular Electronics**.—A field of electronics that utilizes materials with extremely thin sections to take advantage of the electrical amplifying, resistance, and storage capacities of certain molecules.
- Moment**.—See **MOMENT**.
- Monkey Chatter**.—In radio, the sound resulting from cross modulation of side-band radiations from a strong adjacent channel and the signal of the desired frequency band.
- Monochrome**.—In television, the standard black and white picture image.
- Monte Carlo Method**.—A technique for mathematical problem solving which involves simulating the process under study by means of a model constructed from random numbers. See also **OPERATIONS RESEARCH—Techniques**.
- Morsing**.—Cutting square or rectangular holes in wood, usually for the purpose of making a joint.
- Mottle**.—A mixture of colors or shades to give a complicated pattern of specks, spots, or streaks.
- Mount**.—The assembly containing all the electrical and structural elements within the bulb of an electron tube, including cathode, heater, getter, deflection plates, ceramic separators, and lead wires.
- Muck Iron**.—The lowest grade of wrought iron.
- Mud**.—The chemically treated clay solution used to lubricate oil-drilling bits and to carry waste materials to the surface. Mud also plasters the wall of a well to keep its sides from caving in when the drill is withdrawn.
- Negatron**.—A four-element vacuum tube with negative resistance characteristics.
- Neoprene**.—See **CHEMICAL INDUSTRIES—Synthetic Rubber; RUBBER, SYNTHETIC—Neoprene**.
- Nesting**.—Packing units one inside the other to save space in shipment.
- Nipple**.—A short piece of pipe having a thread cut on the outside surface, used for joining sections of pipe together.
- Noble Gases**.—The inactive gases characterized by a complete outer (or sub) shell of electrons.
- Noise**.—Undesired interference with the intended electrical signal in a circuit. See also **ELECTRONICS—Amplifiers**.
- Oiling Off**.—Applying neatsoft or other oils to hides to make them pliable and soft.
- Opener**.—A machine which tears apart, loosens, and fluffs up cotton fibers before their processing into yarn or thread.
- Optical Comparator**.—A device for measuring the accuracy of a generated surface shape by projecting its magnified silhouette on a translucent screen containing an accurately enlarged pattern of the desired shape.
- Oscillator**.—Any device that generates oscillations, but particularly the device for generating the high frequency carrier signal for radio or television communications.
- Oscilloscope**.—A device for determining the amplitude, timing, and shape of electrical pulses by displaying their characteristics on the face of a cathode-ray tube.
- Packing**.—Any material used to obtain a fluid-tight seal between mating parts that move relative to one another.
- Pad**.—(1) A mangle used to apply dyestuffs to fabric. (2) A device for attenuating electrical signals.
- Palletize**.—To prepare materials on low, flat wooden racks called pallets. Sometimes this enables shippers to obtain lower freight rates because of simplified handling.
- Paneling**.—Impressing rings into the end of a cylindrical can to increase its strength.
- Parkerizing**.—Applying a protective iron phosphate coating to iron or steel.
- Peaking Circuit**.—In television, an electrical circuit to extend the frequency response of the video amplifier.
- Phantom Freight**.—Charges for hauling freight over distances not actually covered; the difference between freight cost from the basing point to the consumer and the lower actual freight from the producing mill to the consumer.
- Phenolics**.—Plastics normally derived from the reaction of phenol with an aldehyde. One of the most common plastic bases, it normally forms a thermosetting plastic.
- Photocell**.—An electron tube activated by light or other radiations. The complete photocell circuit and apparatus usually measure the radiation or use it as a signal to operate some other device.
- Picking**.—Opening and cleaning textile fibers and forming them into continuous mats preparatory to spinning.
- Picks**.—(1) The number of filling threads per inch in a woven fabric. (2) The speed at which a shuttle weaves filling threads in a particular cloth.
- Pickup**.—In electronics, a device for converting sound, picture, or other intelligence into electric signals.
- Pig**.—Metal as it is initially cast for marketing.
- Pig Iron**.—See **IRON—4. Pig Iron**.
- Pitot Tube**.—A device for measuring the velocity head of water by seeing how high above its surface water will rise into a special orifice. See also **ANEMOMETER**.
- Plasticizers**.—High-boiling liquids added in plastic manufacture to make molecules flow more easily during molding or forming.
- Plat**.—A scale diagram of a land area showing boundaries but not its cultural or relief features.
- Plate**.—That part of an electron tube which attracts electrons when it is positively charged.
- Polarization**.—The process by which vibrations of light or other radiations are confined to one plane. See also **POLARIZED LIGHT**.
- Poling**.—In metallurgy, the reduction of copper oxide in molten blister copper by inserting a green wood into the liquid.
- Pore Volume**.—The empty space between bits of cemented abrasive in a grinding wheel.
- Porgie**.—The raw material, largely menhaden and offal, from which fish oil is extracted.
- Pot**.—In electronics, a potentiometer.
- Poteye**.—In textiles, a hole through which cloth passes to form it into a loose rope for easy handling during finishing operations.
- Powder Metallurgy**.—The process of using finely divided metal powders to make useful articles. The process involves pressing particles into intimate contact and then sintering them into solid shapes. See also **METALLURGY—5. Physical Metallurgy**.
- Preforms**.—In plastic molding, loosely compressed powder in the size and shape to be introduced into the mold.
- Primary Coil**.—In electricity, the wire winding through which the inducing alternating current is sent.
- Programming**.—The process of arranging information and computer circuitry so that the computer can manipulate information as desired.
- Prony Brake**.—A device for measuring mechanical horsepower. See also **DYNAMOMETER**.
- Proration Laws**.—Laws that govern the amount of oil that may be produced in a state. Their purpose is to stabilize prices, prevent chronic oversupply, and avoid rapid uneconomic exploitation of new oil discoveries.
- Puddling Furnace**.—A furnace in which cast iron is converted into wrought iron.
- Pugmill**.—The mill for mixing and kneading clay in brick or earthenware manufacture.
- Putrefaction**.—In chemicals, the decomposition of organic materials under conditions of oxygen deficiency. This results in ill-smelling gases.
- Putting Up**.—In textiles, cutting cloth into shorter lengths after finishing and preparing it in rolls, bolts, or folds, according to customer specifications.
- Pyrometer**.—A device for measuring high temperatures by means of thermoelectric current, the expansion of

- gases, and the intensity of light radiations.
- Quick Make.**—A special spring device on a switch or circuit breaker for high-speed contact closing.
- Radiography.**—Photography using high-energy particles, instead of light, to activate the sensitive plate.
- Rasper.**—A machine for breaking up chemicals that have blocked or hardened.
- Raster.**—In television, a complete pattern of scanning lines on a cathode-ray tube.
- Rate Base.**—The investment upon which regulating commissions allow public utilities a predetermined percentage of profit return.
- Rat Race.**—A hybrid ring junction of wave guides.
- Recalcence.**—A phenomenon in which iron or other ferromagnetic materials temporarily heat and expand of their own accord during the cooling process.
- Reciprocity.**—The practice of buying from a customer in order to obtain trade advantages in selling to him (or vice versa).
- Red Dog.**—A red-colored ash residue resulting from the combustion of waste coal products.
- Red-hardness.**—The hardness of a metal when it is at red heat.
- Reducing.**—(1) Removing oxygen from a compound. (2) Removing nonmetallic elements from impure metal or metallic ores.
- Regenerating Furnace.**—A furnace in which the heat of the waste gases is used to heat the incoming air blast. Where gas is used for fuel, this also is heated by the hot waste.
- Regenerator.**—In oil processing, a unit for ridding a used catalyst of chemical contaminants that it may have picked up.
- Reinforced Concrete.**—See CONCRETE.
- Repressuring.**—Pumping water or gas into an oil reservoir to restore pressure as the oil is depleted.
- Retort.**—A container in which a chemical reaction can take place under controlled pressure conditions.
- Riprap.**—An irregular arrangement of stone or other materials in a wall to prevent water from washing out the soil behind it.
- Rocker.**—In construction, a support for the free end of a bridge or truss. It allows the structure to expand or contract without building up internal stresses.
- Roving.**—The process of reducing textile slivers to suitable size for spinning. Slivers are passed through rollers and wound on bobbins, and in the process the fibers are given a slight twist. See also TEXTILE MACHINERY.
- Runner.**—The main revolving part of a hydraulic-reaction turbine, including the hub and blades.
- Safety Factor.**—The ratio of the working strength of a member to the actual stress to which it will be subjected.
- Samming.**—Adding uniformly distributed moisture to hides by packing leather in sawdust and storing it under proper conditions.
- Sanforizing.**—A patented, controlled shrinking process designed to reduce the potential shrinkage of textile fabrics to less than 1 per cent.
- Scabble.**—In stonecutting, to dress roughly with a hammer.
- Scale Breaker.**—A metal-rolling mill with special rolls to break the scales from ingots. The broken scale is then blasted away by jets of water.
- Scanning.**—The process by which an electron beam traces out its information on the face of a cathode-ray tube.
- Scray.**—In textiles, a trough through which cloth passes.
- Screed.**—A board used to level off concrete.
- Screw Machine.**—An automatic turret lathe having an automatic through feed for bar stock, and often having multiple spindles to allow several simultaneous machining operations.
- Scrolling.**—A method of cutting strips of tin plate to minimize the waste material between the circles punched out for ends of cans.
- Scuff.**—Material that flakes off the surface of a metal; dross.
- Sealing In.**—Fusing the bulb and mount of an electron tube.
- Seconds.**—Products which do not meet the quality standards of the plant, but are sold on the open market at a reduced price.
- Seismic Survey.**—The process of determining geological characteristics of subsurface structures by planting an explosion and recording the pattern of returning shock-wave echoes. It is commonly used in ore and oil prospecting.
- Selsyn.**—A device for transferring mechanical displacement to a distant point; a portion of a servomechanism.
- Semiconductors.**—Electrical conductors having a resistivity at room temperature between that of metals and insulators; characteristically, their electrical carrier concentration increases with temperature over some temperature range. See also ELECTRONICS—*Diodes*.
- Shaving.**—In leather processing, cutting away the extra thickness of skin along the backbone line of a hide.
- Shrink Mixing.**—Completing the mixing of concrete in a truck mixer after the ingredients have been stirred together initially in a stationary mixer.
- Shrinkage.**—Production units lost because of production errors.
- Sill.**—A timber laid flat to support a structure.
- Singeing.**—Passing cloth rapidly through gas flames to burn off fuzz, lint, and loose threads.
- Skelp.**—An iron or steel strip from which rods or tubes are made by bending and welding.
- Skewback.**—In construction, the first or bottom stone in the curving section of an arch. It has a horizontal base and sloping top surface.
- Skid.**—A strong metal and wooden pallet serving as a base on which heavy machinery or materials can be dragged.
- Skin-dried Molds.**—Sand molds whose metal contact surfaces are specially hardened to withstand the heat and pressure of molten metal better than green sand does.
- Skip Cars.**—Vehicles for hoisting iron ore, coke, and limestone to the top of blast furnaces.
- Skull.**—The film of metal or dross remaining in a ladle after the metal has been poured off.
- Sky Wave.**—That part of the energy radiated from an antenna which does not follow the earth's curvature but goes upward to be reflected or partially absorbed by the ionosphere.
- Slagging.**—The process of covering a test spoon with slag before sampling the metal in a heat.
- Slake.**—To make lime crumble by contact with water.
- Sleeve.**—A hollow tube of soft metal into which a rod or bar is inserted. It is similar to a bearing, but not intended to withstand the friction of continuous rotation.
- Sley.**—The number of warp threads per inch in a woven fabric.
- Slip Casting.**—Making earthenware by casting fluid clay.
- Sliver.**—A soft rope of textile fiber as it comes from carding prior to spinning.
- Slops.**—The sludge left after a chemical process.
- Slurry.**—A thin watery mixture carrying minerals in a chemical process.
- Snag.**—To remove the unwanted parts of a casting by rough grinding.
- Snatch Block.**—A special block used in hoisting or pulling. It has an easily opened side for quickly connecting rope.
- Snow Cat.**—A caterpillar-tracked car or truck used to work in snowy areas where removal of snow is not feasible.
- Sole Plate.**—A plate fastened to the bottom of a beam or truss to serve as a bearing plate on masonry.
- Solidus.**—The temperature below which a material is completely solid.
- Souring.**—In leathermaking, the treatment of leather with weak organic acids, to remove stains and to bleach the surfaces preparatory to dyeing.
- Spacer.**—A casting, usually spool shaped, used to separate girders in a structural member.
- Spaghetti.**—Insulated sleeving used on thin wires in electronic assemblies.
- Spinnerets.**—Devices with small holes through which liquid synthetic-fiber materials are forced in spinning threads of the fiber.
- Spinning.**—In metalworking, forming round hollow ware by pressing sheet metal into a mold revolving on a lathe.
- Splitting.**—Dividing hides into two or more layers of uniform thickness for leather manufacture.
- Spooler.**—A machine to wind the contents of several bobbins into a longer continuous length called a spool.
- Spot.**—A commodity bought or sold for immediate delivery.
- Sprue.**—A hole through which molding material is poured into the gates of the mold and thence into the mold cavity.
- Stadia.**—A method (or the equipment) used to determine distances in surveying by observing the space on the rod scale intercepted by hairlines on the telescope.
- Staking.**—A process by which leather is softened by pulling and kneading.
- Stand.**—(1) A mill used to roll blooms, slabs, or billets into semifinished or finished shapes. The terms "two high," "three high," and so on, indicate there are two, three, or more rolls in the stand. (2) Three or four lengths of drill pipe used in oil drilling. The drill pipe is removed in stands to replace or repair a worn drill.
- Steeping Pits.**—The bins in which cloth is stored while a desizing solution dissolves entrapped starch.
- Sticker.**—(1) A machine to mold and shape wood stock parallel to the grain. The sticker usually has four rotating cutter heads, one for each surface. (2) A piece of material used to separate pieces of lumber in storage.
- Stirrups.**—In construction, U-shaped bars used in rein-

- forcing concrete beams against shear or diagonal stress.
- Straight-run Gasoline.**—A condensate of vapor from crude oil boiled off at 90° to 410° F.
- Stratigraphic Trap.**—One of several common geological formations which form natural traps for oil. It occurs when one rock stratum bows upward at its edges to form a natural bowl to trap liquid subsurface oil.
- Straw Boss.**—A person, usually a subforeman on a work crew, who takes responsibility during frequent absences of the foreman.
- Stretch.**—In masonry, a stone with its greatest length parallel to the direction of the wall.
- Stria.**—Surface or internal threadlike inhomogeneities in transparent plastic.
- Stringer.**—(1) A longitudinal member of a bridge used to support the roadway over it. (2) A beam directly supporting the floor of a structure.
- Stripping.**—(1) Removing molds from ingots. (2) Removing the top layer(s) of soil to work the mineral deposits below. (3) Tearing or breaking off the threads of a screw or the teeth of a gear.
- Stumpage.**—Money paid an owner for standing timber.
- Subpunch.**—To punch a rivet hole smaller than the rivet size so that the weakened metal can be removed by reaming before riveting.
- Sump.**—A hole or well into which water may be directed to drain an area.
- Sun Ray.**—A semiglossy finish generally applied to the inner sides of aluminum ware.
- Supercharger.**—A device to compress air before it enters an internal combustion engine for the purpose of improving the efficiency of the engine.
- Superelevation.**—In roadway construction, the height by which the high side of a banked roadway curve exceeds that of the lower sides.
- Superfinishing.**—An abrasive process that removes small particles of metal and minute surface imperfections after ordinary machining operations.
- Surge Tank.**—A liquid-holding tank used to absorb irregularities in fluid flow.
- Surplus.**—All accumulated profits from operations not specifically reserved for a particular use.
- Swell.**—The increase in volume between excavated grading material in its natural state and the volume of the same material in an embankment after it settles.
- Swing.**—One method of describing lathe size. The term refers to the maximum diameter (in inches) of an object that can be rotated without interference over the bedways or compound rest of the lathe.
- Sync Signal.**—The signal employed to synchronize a cathode-ray tube's scan timing with that of some outside signal source or output.
- Tackle.**—An arrangement of rope and blocks used to move or lift heavy loads.
- Tag Line.**—A light wire or rope used to keep a bucket from twisting as it is hoisted.
- Tailings.**—Rejected matter, such as stones that do not pass through the largest screen after crushing.
- Tapping.**—(1) Releasing molten metal from a furnace. (2) Cutting an internal (female) thread.
- Teeming.**—Pouring molten metal into ingot molds.
- Telemeter.**—A device for or the process of measuring phenomena at a distance and transmitting the measurement information to a collection point by radio, telegraph, or television.
- Telpher.**—An electric hoist operating on an overhead track.
- Tenderness.**—The relative resistance of a material to localized stress as at corners, bends, holes, or flex points.
- Tenoner.**—A machine used to form and shape wood at right angles to the grain, particularly to make tenons for joining.
- Tenter.**—In textiles, a machine for drying cloth over a long flat frame. It is used before printing cloth to make sure that threads are in proper squared position.
- Terneplate.**—A ferrous metal sheet covered with a lead-tin alloy and cast in a hot-dip process.
- Test Pattern.**—A video signal transmitted over the air or in a closed-circuit system to test television receivers and/or transmitting equipment.
- Thermal.**—Any device using the electromotive force developed by holding the two junctions of a two-metal circuit at different temperatures; a thermocouple.
- Thermionic Emission.**—A phenomenon in which electrons or ions are boiled off by an emitter when it is heated.
- Thermos-bottle Car.**—A vehicle to transport molten pig iron from the blast furnace to open hearths.
- Tie.**—(1) A tension member of a truss. (2) A surveying term for measurements made to locate the position of a remote point by reference to points of known position.
- Tipping Off.**—Closing off the exhaust of an evacuated electron-tube bulb.
- Tocco Process.**—A method of hardening the surface of steel by induction heating.
- Toggle Joint.**—A mechanism consisting of two bars joined end to end but not in line. When pressure is applied at the point where they are joined, the mechanism tends to straighten out and exerts a strong horizontal pressure if confined.
- Tooled.**—A finished surface made by dressing leather with a brush hammer or crandall.
- Top Pressurization.**—A process in which blast furnaces, instead of being open at top, are sealed and air is forced through under pressure to increase the furnace yield.
- Torpedo.**—(1) A spreader that forces molded material against the walls of the mold cavity. (2) An explosive charge used to clear obstructions in an oil well.
- Townsend Avalanche.**—An effect produced when one ion creates others by collision and these in turn create more ions, resulting in cumulative ionization.
- Tracer.**—A foreign substance, usually a dye or radioactive element, introduced into a dynamic system to see how the system is performing.
- Train.**—A series of metal-rolling stands placed close together for continuous rolling of sheet metal. Several mills in a train normally contact the metal strip simultaneously.
- Transducer.**—A device by which energy from one transmission system can flow to another. Often the input and output energies are of a different form, as electrical to acoustical.
- Turbohearth.**—A steelmaking furnace similar to the Bessemer, in which air is blown over the metal surface rather than through it.
- Tying In.**—In textiles, tying threads of a new beam onto those of the old beam when it runs out.
- Universal Grinder.**—A grinder that usually can finish flat, round-external, round-internal, and special-form surfaces.
- Universal Joint.**—A fastening that allows the connected shafts to move in both vertical and horizontal planes while rotating.
- Venturi.**—A gradual restriction in the opening of a hydraulic tube, used to measure fluid velocity.
- Vertical Integration.**—The process of a company's growth by acquiring (1) distributive operations closer to the consumer (forward integration), and/or (2) production operations that give it greater control over its raw materials or fabricated parts (backward integration).
- Vinyls.**—Plastics derived by polymerizing a vinyl ($\text{CH}_2\text{CH}-$) compound. They are among the most common plastic bases, usually forming thermoplastic material.
- Viscosity.**—See VISCOSITY.
- Vitrification.**—The consolidation or incipient fusion of material into a glassy mass under the influence of intense heat.
- Voder.**—An instrument for the synthetic production of human speech.
- Wafer.**—In electronics, a flat ceramic part on which circuits can be printed. Wafers are joined together to form complete sections (called modules) of electronic circuits.
- Water Cushion.**—The pool of water at the foot of a dam spillway. Its purpose is to break the force of the water coming over the dam.
- Wattles.**—Bundles of brushlike material used in erosion control on steep slopes.
- Wave Guide.**—A device for conducting high frequency electrical energy. It consists of carefully dimensioned hollow conducting tubes through which energy flows.
- Waybill.**—A paper that accompanies goods in transit. It describes the goods and gives all shipping instructions pertaining to them.
- Web.**—(1) The section of a girder or I beam between the flanges. (2) The relatively thin sections of metal used to separate and support the major stress-bearing parts of a cast-metal part.
- Weep Holes.**—Openings left in retaining walls, abutments, and aprons to relieve pressure by allowing water to drain through.
- Wildcatting.**—Drilling for oil in areas where there are no proved reserves.
- Woof.**—The crosswise interlaced strands in woven fabric; the weft.
- Wringing Fit.**—A metal-to-metal, shaft-to-ring fit with no negative allowance. The shaft must usually be inserted under slight pressure.
- Yagi.**—A television antenna array usually consisting of parallel driven element(s) plus parasitic elements. It is used for reception where the signal is weak.
- Yankee dryer.**—A large steam-filled drum used as the first stage in the process of drying paper after the pulp fibers have been initially pressed together.

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INDUSTRIAL VOCATIONAL TRAINING. See EDUCATION AND INDUSTRY.

INDUSTRIAL WORKERS OF THE WORLD (IWW), a labor organization of revolutionary character, with tenets similar to those of the syndicalists (see SYNDICALISM) which, in the early 20th century played an important part in labor history. The organization was founded at Chicago, Ill., in the summer of 1905, its chief component body being the Western Federation of Miners. Established in opposition to the craft unionism of the American Federation of Labor, by such men as Eugene V. Debs, Daniel De Leon, and William D. Haywood, the IWW had as its objective the overthrow of capitalism by socialism. The issue of political action led to the withdrawal in 1908 of a group under Daniel De Leon, who organized a rival IWW, which was later known as the Workers' International Industrial Union. Although it came to be represented in Canada, Australia, and, to a slight degree, in Europe, the IWW's chief strength was in the United States. Members, known as "wobblies," included lumber and mining workers in the west, wheat workers in the central states, textile workers in the east, and dock workers in port cities. Peak membership was reached in 1912, when the organization numbered about 100,000 members. The IWW conducted 150 strikes, among them a strike of textile workers at Lawrence, Mass., in 1912; a strike of silk workers at Paterson, N. J., in 1913; and a strike of iron workers at the Mesabi Range in Minnesota in 1916. The IWW opposed World War I, and in 1918 Haywood, its national secretary and chief organizer, and various other members were convicted of sedition and imprisoned. Perhaps the most serious clash in which the IWW was involved was that at Centralia, Wash., on Nov. 11, 1919, when a riot ensued after a parade of World War veterans was fired upon from an IWW hall, with one of the members taken prisoner later being lynched. Among factors in the decline of the IWW were its activities during World War I and the severe penalties imposed, including public expressions of disapproval; and the rise of other organizations, among them the Communist Party and the Congress of Industrial Organizations.

INDUSTRIALISM, a term used to describe a social organization dominated by industries, particularly large-scale industries. See INDUSTRIAL REVOLUTION, THE; UNITED STATES—23. *Industry*.

INDY, an'dé', **Vincent d'** (in full PAUL MARIE THÉODORE VINCENT D'INDY), French composer: b. Paris, France, March 27, 1851; d. there, Dec. 2, 1931. He was educated by his grandmother, his mother having died while he was still young. During 1862-1865 he studied piano with Louis Diémer, and afterwards he studied harmony and theory under Antoine François Marmontel and Albert Lavignac. After serving in the Garde Mobile during the Franco-Prussian War (1870-1871), he studied composition with César Franck. He entered the Conservatory at Paris when Franck became professor of organ there in 1873 and continued his studies with him until 1880. During 1873-1878 he was chorus master and tympanist with the Concert National, founded by Édouard Colonne; and in 1871, together with Franck, Camille Saint-Saëns, and others, he

founded the Société Nationale de Musique. He served as the society's secretary until 1890, when he became president. Together with Félix Alexandre Guilmant and Charles Bordes, in 1894 he founded the Schola Cantorum, where he taught and, after 1911, served as sole director. In 1912 he became professor of the orchestra class at the Conservatory. His numerous compositions include *La Forêt enchantée*, a symphonic legend (1878); *Le Chant de la cloche*, a dramatic legend (1879-1883); *Wallenstein*, a symphonic trilogy (1874-1884); the lyric dramas *Fervaa* (1889-1895) and *L'Étranger* (1898-1901); *Symphonie Cévénole (sur un chant montagnard français; Symphony on a French Mountain Air 1886)*, for orchestra and piano; *Istar*, symphonic variations (1896); piano compositions; chamber music; and three symphonies. He was the author of several books, including *Cours de Composition musicale*, with Auguste Sérieyx (3 vols., 1903-1933); and biographies of Franck (1906) and Ludwig van Beethoven (1911; Eng. tr., 1913).

INE or **INI** (Lat., *INA*), West Saxon king: d. Rome, c.726. Son of Cenred, a West Saxon underking, Ine was chosen king of the West Saxons in 688, succeeding Caedwalla who had resigned the throne. Like his predecessor, he and his wife Aethelburh were of the royal line of Ceawlin. Following Caedwalla's example he invaded Kent to avenge the death of Mul, who was Caedwalla's brother, and probably his own uterine brother. King Wihtred of Kent in 694 paid him 30,000 pieces of money as wergild for Mul. The war gained Ine as well hegemony over all land held by the English south of the Thames, including East Anglia and Essex. A war in 710 extended his kingdom westward and it probably thereafter included part of Devonshire. His only brother Ingild, who died in 712, was the great-grandfather of Egbert (q.v.), first West Saxon king of all England. In 715 Ine defeated invading Mercians. Meanwhile, between 690 and 693 he published a series of laws, the earliest extant West Saxon legislation. Already London had been included in his domain. The laws indicate that Welshmen in the kingdom, who had accepted Christianity, were legally protected. It is supposed that Ine's mother was a Welshwoman, and Welsh legend assimilates him to the folk hero Ivor. After a 37-year reign Ine abdicated and with his wife Aethelburh made pilgrimage to Rome where he died soon after his arrival.

INERTIA, in-ûr'shâ, *in physics*, that property of a material body which tends to resist any change in its existing state of rest or motion. The concept of inertia provides the basis for Sir Isaac Newton's *first law of motion*, published in his *Philosophiæ Naturalis Principia Mathematica* (1687). The law states that a body at rest tends to remain at rest, and a body in motion tends to remain in uniform motion in a straight line (that is, without acceleration), unless acted upon by an external force. The force in question must overcome the inertia of the object in order that either the speed or direction of motion of the object will change.

Inertia is a function of the mass of the object (the quantity of substance it contains) and, in the case of a rotating object, the distribution of mass with respect to the axis of rotation. It is a commonly observed fact that—even with negligible friction, as in moving an object over ice, or on a

smooth film of oil—a greater force is required to set a heavy object in motion than a light one. The same situation applies to the force required to stop a heavier object, once under way. Mass thus provides a quantitative measure of inertia, but the effect of inertia is observable only when the object has been subjected to an acceleration.

If a pebble and a rock are both hurled into the air with identical force, the pebble travels faster and farther than the stone. The factor responsible for the observed difference is inertia. A heavy car will coast farther after the brakes are applied than a light one; a car traveling at fast speed can leap a ditch as if it were not there. The same inertial effects of mass, together with the associated concepts of *momentum* and *impact* (q.v.), also account for the greater damage done to a smaller car in collision with a larger one, even though the two cars are traveling at the same speed.

Conversely, inertia is responsible for the fact, as Galileo (1564–1642) first proved in his famous experiment on the Leaning Tower of Pisa, that a body of large mass and one of small mass fall at the same speed under gravity. According to Newton's law of gravitation (see GRAVITATION), a twenty-pound object exerts a gravitational force against the earth which is twenty times greater than that produced by a one-pound object, and if gravity alone is considered, the heavier object should fall twenty times as fast. However, the twenty-pound object also has twenty times as much inertia or resistance to velocity change under the force of gravity. Accordingly, the one-pound and twenty-pound objects fall with equal speed.

Inertia is that property which causes an object to fly off tangentially from rotation in a circle, as in the case of an object twirled about the head on a rope and then let go. Thus, if *centrifugal* force is thought of in its restricted physical sense as only a reaction to *centripetal* force, it is the balance between inertia and gravitational force which keeps the planets and other members of the solar system revolving in closed orbits about the sun, and the satellites about their planets.

In the case of a rotating object, the distribution of mass with respect to the axis of rotation is also important, and introduces the concept of *moment of inertia* (see MOMENT). Representative values of the moments of inertia for various solid figures are as follows (where R is the radius of the body or of its circular cross section, and M is its mass):

	Moment of Inertia, I
a. Solid sphere about any diameter	$\frac{2}{5} MR^2$
b. Solid cylinder or disk, about an axis through the center, and perpendicular to the circular cross section	$\frac{1}{2} MR^2$
c. Hoop or <i>thin</i> ring about any diameter	$\frac{1}{2} MR^2$
d. Hoop, <i>thin</i> ring, or hollow cylinder about an axis through its center and perpendicular to the circular cross section of the body	MR^2
e. Ring or annulus (inner radius R_1 , outer radius R_2) about an axis through its center and perpendicular to the circular cross section	$\frac{1}{2} M (R_1^2 + R_2^2)$
f. Solid disk about any diameter	$\frac{1}{4} MR^2$

Since inertia is that physical quality which provides the tendency for a moving object to coast even after the propelling force has been

removed, several interesting cases where rotation and translation (straight-line motion) occur simultaneously may be analyzed from the above table. It is an inviolable law of physics that as the value of I decreases, the speed of rotation increases. Thus if a ball, a disk, and a hoop, regardless of their individual masses and radii, are started rolling down a hill together, the sphere a will roll to the bottom first, because its value of I is smallest; it will be followed by the disk b , and finally the hoop d . The same three objects placed separately on light frictionless sleds will *slide* down the hill in equal periods of time, each faster than the ball will roll down. A heavier man will coast faster downhill on the same bicycle and with the same initial impulse than a lighter man, but if heavier tires or rims are substituted, the coasting speed will be decreased.

Because of the necessity in modern naval fire-control systems (see GUNNERY) to assure a stabilized reference free from the effects of roll, pitch, and yaw of the ship, the tracking coordinates for a target aircraft are usually referred to an *inertial* or space-fixed coordinate system, which, through gyrostabilization, is independent of deflectional influences produced by the motions of the vessel.

Similarly, since no point in the universe is at absolute rest, a set of coordinate axes fixed with reference to the average of the space motions of the stars and known as the *primary inertial* system or *fundamental standard of rest* is chosen by physicists and astronomers, with respect to which origin individual motions in space may then be more rigorously defined.

Certain relativistic concepts of inertia are also noteworthy. According to the theory of relativity set forth by Albert Einstein (1879–1955), since mass increases with velocity, inertia does also (see RELATIVITY—*Einstein's Relativity of Time and Space*). The value of inertia is therefore assumed in this theory to increase rapidly as the velocity of light, 186,282 miles per second, is approached. At this point, inertia is presumed to become infinite, so that continuous acceleration of the object to reach or exceed the velocity of light is impossible.

See also FORCE; MECHANICS.

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INFALLIBILITY, ɪn-fəl-i-bil-i-ti, exemption from the possibility of error. The word is used as applied to arguments, statements, reasoning, or the formation of judgments.

The infallibility of the Roman Catholic Church means that the church cannot err in its judgments concerning matters of faith or morals. The seat of infallibility rests in the pope as successor to St. Peter (Matthew 16:18). In the acts of the Vatican Council held in Rome in 1869–1870, during the pontificate of Pius IX, the following is the text defining the nature of the infallibility of the pope:

"the Roman Pontiff, when he speaks *ex cathedra*—that is, when in the exercise of his office as pastor and teacher of all Christians he defines, by virtue of his supreme Apostolic authority, a doctrine of faith or morals to be held by the whole Church—is, by reason of the Divine assistance promised to him in blessed Peter, possessed of that infallibility with which the Divine Redeemer wished His Church to be endowed in defining doctrines of

faith and morals; and consequently that such definitions of the Roman Pontiff are irreformable of their own nature (*ex sese*) and not by reason of the Church's consent." The Orthodox Eastern Church and certain Anglicans maintain, with Roman Catholics, that Christ promised the true church infallibility.

Consult Toner, P. J., "Infallibility," *The Catholic Encyclopedia*, vol. 7 (New York 1910).

INFAMY and INFAMOUS CRIMES, in common law the first means disqualification from giving legal evidence as a result of having committed the second, the theory being that a person capable of such crimes is incapable of speaking the truth. Both in Great Britain and generally in the United States this disqualification has been abolished by statute, and previous convictions for crime have been considered to affect a person's credibility without impairing his legal capacity to give evidence. Infamous crimes are strictly those which entailed punishments. The fifth amendment to the federal Constitution speaks of "capital or otherwise infamous crime" and we read in Nathan Dane's *General Abridgement and Digest of American Law*, vol. 2, pp. 567-570: "Punishments clearly infamous are death, gallows, pillory, branding, whipping, confinement to hard labor and cropping." Infamous punishments include imprisonment in state prison or penitentiary with or without hard labor, and crimes which entail such punishments are undoubtedly to be considered infamous crimes, in the sense implied in the 5th Amendment to the Constitution.

INFANCY AND INFANT CARE. The human being from birth to about 12 months has received more and more study and attention in the past several decades. No other period of history has witnessed such great advances in research on how children grow and develop as has the last half-century. And increasing emphasis has been placed on the effect of what the individual experiences in infancy. The physical, mental, emotional, and social aspects of a child's life are coming to be seen as constantly interwoven, although we still speak of them separately.

The Newborn.—The infant who not so long ago was generally looked on as a "lovable bundle," with no particular ability to feel or think or react, is recognized today as a very impressionable being indeed. The newborn—weighing an average of about 7½ pounds, measuring about 20 inches in length (individual babies range from "very small" to "very large," and all are normal), often with too much or no hair, eyes that "float," an over-large head and stomach, and sometimes a mottled, reddish skin—may appear as something less than human and remarkably helpless. But he can cry, he can feel warm or cold, he can smell and taste, he can cough and sneeze, he can sense hunger pangs and the need to suck. Above all, he can feel loved or not. The skin of the newborn seems to be especially sensitive and he responds to contact, patting, and caressing. He senses whether he is being held snugly and firmly, or distantly and awkwardly. So the impulses parents feel to cuddle and protect the infant, to handle him gently, fit in precisely with his needs. Scientific study has shown that infancy passed in such a loving, warmly dependable environment has the best chance of resulting in secure, outgoing, and confident adulthood.

Feeding.—Along with new findings on *what*

to feed the infant have come important discoveries on *how* to feed him. Whether the baby's milk comes from breast or bottle, physical contact with his mother evidently adds to the satisfaction of feeding. Authorities in various fields of child development have at times insisted that the breast is the only satisfactory way of feeding an infant, and this has aroused a feeling of guilt and resentment in some mothers. The trend today is to recommend breast feeding within the framework of a mother's desires. A working mother, or one who cannot or for any reason does not wish to nurse, is not likely to have for her baby a love untinged with resentment if she *forces* herself to breast feed him. In addition, science has so perfected formulas for infants that there is no danger of a bottle-fed baby being undernourished. However, breast feeding is recommended wherever possible, since many physicians believe it offers an advantage to the baby, physiologically as well as emotionally, and because of the definite advantages that result from the mother's own satisfaction in nursing her baby.

Whatever the method of feeding, the baby needs affectionate handling, plenty of time, and a relaxed atmosphere, just as much as the milk itself. In the early studies of infants' needs, "self-demand" became a significant concept, its theory being that all infants differ in appetite or food needs, both as to quantity and as to time intervals.

In other words, infant hunger cannot be gaged by the clock. This theory was for a time misinterpreted by mothers and fathers anxious to be ideal parents, and many a baby found a bottle in his mouth almost every time he opened it. From this rather violent swing away from the old rigidity, there has been a settling down to a reasonable, commonsense self-demand principle. Infants who are fed when it is reasonable to think they are hungry (and not merely when they are crying—which they could do for a variety of other causes) have been found, in general, to work out a fairly regular feeding schedule of their own several weeks after birth.

Weaning.—The method used in weaning is another influential factor in a child's subsequent attitude toward food and toward people. The decision that a baby should be ready to give up breast or bottle at a certain time is now recognized as arbitrary, and each mother has to work out the weaning experimentally. In most cases, breast-fed babies can be introduced to bottle or cup at about seven or eight months. If a "relief bottle" has been used previously—that is, if from birth one feeding a day has been from the bottle—the process is usually easier, since the infant is already acquainted with this way of getting his food and also with the milk. But whether he is already acquainted or not, weaning must be a step-by-step procedure, beginning with substitution of one bottle feeding for one breast feeding for a few days, then another substitution for the next few days, and so on until he appears content to give up the breast entirely. Introduction to a cup for a bottle- or breast-fed infant should also be accomplished in the same leisurely fashion. The infant must have time to get used to the new taste and texture, to the lack of warmth in a rubber nipple or a cup rim, and to the distance from his mother's body.

Solid Foods and Self-Feeding.—When to introduce solid foods is a question to be settled by individual parents in consultation with the baby's physician. Some doctors recommend solids when

an infant is only a few weeks old, others prefer to wait until three or up to six months. The guiding principle, whatever time is decided upon, is that eating is initially a pleasurable experience and should continue to be so. The more anxious parents are to "make sure the baby eats well," the more likely are they to make the child uncomfortable about eating. Most infants begin by sucking small amounts of food from the end of the strange, unfamiliar spoon, and the sucking movements sometimes result in pushing the food out instead of back. But if they are not hurried or urged, they continue in their natural eagerness to be fed.

At one year, more or less, self-feeding begins. Sometimes a baby indicates his readiness for this by wanting a spoon of his own, and sometimes by using his most natural instruments, his fingers. He is encouraged at this notoriously "messy" phase if meat, vegetables, and fruits are furnished in small pieces easy to pick up. His "emotional nourishment" continues if he is not nagged or pressed to be neat and careful, which he is not yet able to be. It is far more sensible if his dishes, for instance, are plastic, his bibs easily laundered (old cloths or diapers), and his eating area protected by a piece of linoleum. "Emotional starvation" in the form of disapproval of the way he eats or of his rejection of some foods, can substantially affect his appetite. Studies of babies have disclosed that, left to their own choice of nourishing foods over a period of time, they select for themselves a well-balanced diet in the long run.

Sleeping.—As they differ in feeding schedule and in appetite, infants also differ in their needs for sleep. Most newborn babies are awake only for feedings, about 2 or 3 hours out of 24. By the time a child is half a year old, this usually changes to about 12 hours of sleep at night and several hours during the day. The daytime sleep may be a few short naps or a short one and a long one. Here again, reasonable self-demand can prevail. There is no harm, for example, if a baby seems to have his wakeful periods at night—when parents need their rest—in deliberately keeping him awake for longer spells during the day or toward evening. Sound sleep is important to his health and happiness, however, and he should not be awakened, for instance, to be shown to eager relatives. In general, by the time an infant has fallen into a regular eating pattern, his sleep pattern also becomes fairly regular. Of great importance for good sleeping conditions is a firm, flat mattress. The flat, unsagging surface is necessary for good posture development and also enables the baby to turn his head easily from side to side.

Bathing.—Every aspect of a child's care enters into his need for satisfactory relationships with others. One contribution to his sense of trust is being bathed by assured, unhurried hands. A bath is fundamentally a pleasant experience for an infant—he is free of clothing, able to move without inhibition, and happy with the sensation of the water.

Since most doctors believe the navel should be kept dry until it is completely healed, daily baths do not usually begin until that has occurred. Subsequently, there need be no rigidity about its being daily. If the house is chilly or the parents tired, it is much better to skip the bath than to expose the baby to chill or to a hasty, tense experience. Having a specific area set aside for the bath, with

all necessary materials and clothing handy, makes it even more enjoyable for the adult and less of a chore. Being placed too swiftly in the water, finding it too hot or cold, feeling that the hand grasping him is unsteady, can arouse fear in the infant and make him unhappy not only with his bath, but also in some cases with later attempts at swimming. Nose, eyes, and mouth need never be cleaned. "Cradle cap," the greasy crust that may appear on the head, can be removed by rubbing in petroleum jelly at night and washing the head thoroughly for several days.

Toilet Training.—Many indications of ill effects from too early or too rigid toilet training raised the practical questions: "When?" and "How?" It is generally agreed that toilet training should not be undertaken in infancy or the first year of life, for most babies are not ready to start learning bowel control before about a year and a half. Only by that time have they developed sufficiently to associate the physical feeling of need to empty waste with a special place for doing it. Hurrying the process may, for one thing, serve to delay it in the long run and, for another, injure the trusting relationship between parent and child. Feeling himself urged to do something he cannot do, and then feeling disapproval, an infant can come to see the pressuring adult no longer as a friend. Even if, out of fearing the disapproval and desiring to please, he does achieve control of a sort, it is not true learning and there is a chance of his reverting to lack of control later in childhood. In addition, it has been shown that children can come to associate the fear and disapproval with their excretory and genital organs.

In judging a baby's readiness for toilet training, it is well to consider whether or not he seems to know what the toilet is for (from having seen the rest of the family use it); whether he gives some signal (grunting, getting red in the face, or straining) just before a bowel movement; whether the movements come at fairly regular intervals; and whether he is willing to sit on the toilet.

Immunization.—Since the time of Louis Pasteur (1822-1895), medical science has provided us with many special techniques for preventing communicable diseases. Standard practice in child care today includes the immunization of children against specific diseases. The oldest kind of immunization in general use is of course smallpox vaccination. The most widely used procedure is to immunize children during the first year against diphtheria, whooping cough, and tetanus with a compound injection that protects against all three diseases. Later the child is vaccinated against smallpox. Some of these immunizations are effective for many years; some have to be reinforced from time to time.

Saving Babies' Lives.—The best indication we have today of the value of the various measures that research workers have developed for improving the health of our population is the striking reduction in the infant death rate since the beginning of this century. The first year of life is the most precarious: during that year more individuals die than at any other age. At the beginning of the century, more than 13 per cent of the babies born alive (135.3 per thousand) died before the end of their first year. In 1954 this rate had dropped to about 27 per 1,000. The factors involved in this great improvement included not merely the medical advances but better homes

and living conditions, better sanitation, better nutrition, better maternal care, better working conditions, and a healthier outlook upon life. A significant feature of the total reduction in the infant death rate is the great variation among different regions and among different sections of the population. In 1949, for example, the infant death rate varied among the different states from less than 24 to more than 60 per 1,000. There are, however, many indications that, with our present technical and economic resources, close to 99 per cent of all babies could be safely carried past their first year.

Creeping and Walking.—Most infants begin to creep or crawl at about eight or nine months and, given the space, move forward not only physically but, intellectually, emotionally, and socially. It is at this time that parents find it best for all concerned to remove perishable or dangerous objects from low shelves and tables; to encourage the creeper to come to them from across the room; and to furnish balls or other rolling toys that he can scuttle after. Playpens are valuable when there is no adult available to watch over the infant, but he should have as much roaming space as is convenient for the family.

At a little less than a year, infants in general begin to pull themselves up to standing position and some take to climbing. Some mothers and fathers sense in themselves, at this phase of their child's growth, the anxiety commonly called "overprotectiveness." The infant needs to climb, but the adults sometimes have undue fear that he will hurt himself. If he is permitted to clamber about under a watchful eye, they usually find that much of their protective impulse is unwarranted. While an infant cannot be permitted to get himself into situations that older people know from experience to be dangerous, he can for the most part take the ordinary bumps inevitable in learning to get about on his own.

There is great variation in the ages at which walking begins, but most babies seem to take their first shaky steps somewhere around a year. They are helped most when adults encourage by voice, praising the attempts, but are not helped when pulled up or held too much by the hands. Walking alone, commonly occurring between 12 and 15 months, opens still wider the fields for the infant's growing curiosity, his desires to expand socially and intellectually. He wants to explore and discover with his body, mind, and feelings.

Talking.—At about a year, infants in general say a word or two with some sense of what they are saying. Before this time, they "speak" in their own way in imitation of adult speech sounds. When they do begin to use specific words, they need even more examples of clear, understandable language in the grownups around them. If their own first babyish attempts are repeated to them, whether teasingly, lovingly, or correctively, as "baby talk," they are likely to repeat these sounds, since they are still imitating. Often, babies who talk a bit before walking will slow down in learning new words while they are learning to walk.

Play.—Playing with a baby comes so naturally to adults, is such a spontaneous part of being with him, that they seldom consider that it can be more than fun. But play is a vital factor in the child's all-round growth. First, the fun of course makes him feel it is good to be with people. He is on the road to understanding others and becoming a social being. The infant who lies lonely in his crib most of the time, attended only when he is wet or hungry, is not likely to start

out on a basis of liking, trusting, and knowing others. Furthermore, play helps the baby develop physically. Aside from play with people, the toys he is given to play with by himself can encourage his skeletal and muscular development. A bright object or "gym" set up over his crib, for example, supplies incentive for stretching and grasping. When he begins to creep, balls or other toys that can be pushed away and then scuttled after help his developing leg muscles. Toys also help satisfy his expanding sensory and intellectual needs. Rattles to shake and listen to, bright pictures to look at, and kitchen utensils to bang, take apart, and try to put together, offer him learning opportunities. Mothers and fathers can often see for themselves what type of plaything their infant is ready for simply by observing what sounds, sights, and objects around him seem to please him most.

Common Problems in Infancy.—It is clear to most of today's parents that the one-time eating and sleeping problems are not innate. Infants have a need to eat and sleep, and barring the effects of illness or physical disorder, problems arising in this connection are created. There are, however, numerous types of behavior that are still called problems because they worry parents. Some of them appear purely physical, some emotional. As has been pointed out, they are usually interwoven. An infant whose parents are so concerned about inhibiting his emotional growth if they should say, "No," that they allow him to eat city sand pile dirt is exposed to disease. On the other hand, the one whose mother and father are so concerned about germs that his clothes are constantly being changed, his hands and face constantly dabbed at, loving relatives kept at a distance, is equally exposed in such a sterile environment to emotional disease. Some of the problems are not directly connected with the infant himself but arise from false concept or rumor. A few of these worries most common to parents are:

Colic.—Symptoms of the intestinal cramps known as colic, usually limited to the first three or four months, are violent crying after feeding, drawing up of the arms and legs in pain, and reddening of the face. The precise cause is not agreed upon. But things to consider in trying to help the baby are: whether he is subjected to too much excitement, whether some food may be the cause, whether he swallows too much air in feeding, and whether his overall environment is a relaxed, easygoing one.

Teething.—At one time, all sorts of sickness were attributed to teething, but in itself it cannot really cause illness. A baby may be fretful and cranky or not eat so well as usual when a tooth is coming in, but if he becomes sick at the time it is not directly because of teething. Having things to bite on, such as hard rubber or plastic rings, will relieve both pain and the urge to bite. There is considerable variation among children as to the times that teeth appear, but on the average infants cut their first two lower middle teeth at about six to eight months and four upper front teeth after a few more months have passed. The set of "baby" teeth is usually complete at about the time the child celebrates his second birthday.

Crib-rocking and head-banging.—Some kind of inner urge, perhaps a need for rhythmic movement or for letting off excess energy, impels many infants to rock themselves so violently that their cribs rock too. In some cases, they bang their heads against its sides. Padding keeps them from hurting themselves, and lack of anxiety about the

matter in the parents keeps from building up a tense atmosphere that may itself contribute to this rocking and banging. If the activity is persistent and parents cannot help but worry, a talk with the baby's doctor may bring some helpful answers to light.

Thumbsucking.—Infants are born with a strong need to suck. In the beginning it is their only way of getting food. Since it is such a source of pleasure and satisfaction, most of them don't seem to get enough of it and take to sucking thumbs or fingers or other objects. Stopping them with "no" or with mechanical devices or more subtle forms of disapproval is very likely to occasion unhappiness, bewilderment, and possibly resentment. Providing pacifiers in some form is more sensible if the use of thumb or fingers is worrisome to the parents. Sometimes excessive sucking is a sign that the infant is removed from the breast too soon, or that the holes in rubber nipples are too large to give him sucking satisfaction. It can also be a sign that he needs more in the way of affectionate attention.

Smothering.—Old wives' tales and news headlines notwithstanding, actual smothering is not a danger for the sleeping baby, as so many parents fear. Infant deaths attributed to smothering are usually caused by some sudden illness. It is a temptation to mothers and fathers to take their baby into bed with them occasionally, but tragic reports of accidental smothering when the parents fall asleep make it a temptation to be resisted. If a baby is lying on a firm, flat surface without a pillow, and with the blankets, sheets, and other bed covers securely tucked under the mattress or pinned down at the corners, there is no danger of a healthy child suffocating.

Spitting up.—Many infants spit up a bit after feeding, in most cases, apparently, because they are too full. It is not generally a sign that anything is wrong. If the amounts spat up are large, or an infant does it all the time, the matter should be called to the doctor's attention.

Hiccups.—Infants frequently have hiccups, especially after a feeding. Ordinarily the hiccups do not last long and are not harmful. Burping the baby, rubbing his abdomen, or giving him a sip or two of warm water will usually dispel them.

Fontanels.—The two soft spots on the infant's head, where the bones have not yet grown together, are actually covered by a strong membrane, and parents need have no fear of washing the infant's scalp thoroughly.

Crying.—All babies cry more or less, since crying is their only means of responding to needs, pain, or discomfort. Hunger, discomfort from wetness or chafing or heat or cold, fatigue, over-excitement, or plain bored loneliness are among the many possible causes. Often, when a checkup fails to reveal any specific cause for crying, and being held and cuddled do not bring relief, parents may discover, by just letting their infant cry for a while, that the wails last only a few minutes and that he then settles down happily.

Breath-holding.—Occasionally, an infant may hold his breath to a point where it seems he will suffocate himself. It has been definitely found that he will not. Breathing is automatic, for a certain imbalance of oxygen and carbon dioxide forces the movements of breathing. If little attention is paid to the breath-holding, or if something interesting is offered to divert the infant's attention, it will pass.

Fears.—It is not uncommon to find parents

worried over the fact that their baby of a few months seems afraid of things that didn't disturb him at all when he was younger. Since there are actually many things in the world that may reasonably be feared until they are understood, such displays of fearfulness are very often a sign of the baby's sensory and intellectual growth. For example, at eight months or so many children suddenly begin to cling to parents who are going out. They have learned that things and people can go away. Handled sympathetically, not shamed or punished, they soon progress to the certainty that these things and people also come back. Of course, outer circumstances can create fears in babies. The noise of a vacuum cleaner, slipping in the bath, being violently seized if he tries to pat a dog, thunder and lightning, and darkness are the sorts of thing that may make a baby inwardly fearful. In such cases, the infant most needs gentle reassurance and the feeling of adult arms around him.

Heredity, Environment, and the Individual.

—The question, "Which is more important, heredity or environment?" is a poor one. The constructive view is simply a recognition of both as inseparable from life and from each other. An individual of a given inheritance is influenced by a given environment in one way; a different individual responds to the same environment differently. Side-by-side with the many studies and conclusions about the *average* infant has grown the recognition of the *individual* infant. Authorities speak of an infant needing *about* so much food, *about* so much sleep, and of walking and talking at *about* a certain age—for the average is put together from the very individuality of thousands of infants. Hereditary physical differences are obvious to most people. What is not generally kept in mind is that personality differences too are observable in the first few weeks of life. Within the same environments, for instance, some babies seem to have "just been born" slow-paced and calm, and others seem to have been born energetic, sensitive squirmers. Some suck heartily and avidly, others slowly.

Although the modern parental attitude toward the importance of environment and the knowledge of phases and growth and development constitutes an immense step toward bringing up healthy and happy children, always the keynote of this attitude must be respect for the infant's uniqueness and his right to be different. Inwardly, the infant has his own pattern and potentiality for development. Outwardly, his needs from adults are affection, guidance, and encouragement. See also CHILD PSYCHOLOGY; CHILDREN, DISEASES OF.

Consult *Better Homes and Gardens Baby Book* (Des Moines, Iowa, 1951); Wolf, Anna W. M., *The Parents' Manual: A Guide to the Emotional Development of Young Children* (New York 1951); *The Encyclopedia of Child Care and Guidance*, ed. by Sidonie Matsner Gruenberg (New York 1954); Spock, Benjamin, *The Common Sense Book of Baby and Child Care* (New York 1955); Wishik, Samuel Malcolm, *Feeding Your Child* (New York 1955).

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INFANT, in law, a person who has not reached the age of majority, which is usually 21 years. At common law, majority is reached on the day before the twenty-first birthday, but it may be attained at an earlier age if the applicable statutes so provide. The status of infancy is attended by numerous legal consequences, in-

cluding provision for care and custody of the infant by the state when necessary, special protection against certain criminal acts, some degree of mitigation of criminal liability, and the application of special rules relating to property transactions and contracts. An infant who is not subject to parental control and custody becomes a ward of the state, which may exercise its guardianship by providing reasonable regulations for the minor's protection. Usually the state provides special courts, charged by statute with the care, control, and custody of neglected children. These juvenile courts also have jurisdiction over delinquent minors, for the primary purpose of rehabilitating them rather than punishing them with the same severity as would be appropriate in the case of adult criminals. At common law, however, children can generally be held liable for crime the same as adults; and it is only by statute that the prosecution and punishment of infants are made subject to substantially different rules than those applicable to adult offenders. The common law allowed complete exculpation from criminal liability only to infants under seven. In legal terminology, such children were said to be conclusively presumed to have no capacity to commit a crime. Between the ages of 7 and 14 there was a presumption of incapacity to commit crimes, which decreased in strength as the child grew older. After 14, an infant was presumed at common law to be completely capable of crime and was accordingly subject to penalties as severe as those inflicted on adults.

In the fields of property and contract law, infants are subject to special rules, which are called disabilities, but which are actually favorable to their interests. The underlying purpose of such rules of law is to preserve the infant's property intact until he reaches majority. An infant may own property and may acquire property rights, but is not permitted to have control and custody of his property and is severely limited in the disposition that he may make of it. An infant's purchase or sale of property is voidable, which means that it can be set aside, or "avoided," if he so chooses after he comes of age. The same general rule applies to most contracts entered into by infants, with the result that the other party to the contract cannot be sure what his own legal rights and liabilities are until after the infant has reached majority. The avoidance of a purchase or contract (also sometimes called disaffirmance) must take place within a reasonable time after the infant attains adult status. Any act on the part of the infant which clearly shows an intent not to be bound by the transaction is sufficient to constitute an avoidance. Examples of such acts are suing to recover the purchase price, interposing infancy as a defense to a suit by the seller for the price, and restoration of the property to the seller. The opposite of avoidance is ratification, an act by a person after reaching majority which indicates an intention on his part that a transaction entered into during his infancy shall be binding upon him as well as upon the other party. Ratification may be accomplished by an express promise to fulfill the terms of an agreement previously made, by performance of such agreement, by retaining or accepting the consideration for a transaction entered into during minority, or by other conduct demonstrating an election by the erstwhile infant not to avoid the contract in question. The general rules limiting an infant's power to make binding contracts are not applicable

to agreements authorized by statute (such as marriage) and agreements for necessities, including food, clothing, shelter, medical services, and education.

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INFANTE, in-făn'tă, the name borne by any legitimate son of a king of Portugal or Spain, with the exception of the eldest. The heir to the Spanish crown was called *El Príncipe de las Asturias*. *Infanta* was the name borne by a daughter of a king of Portugal or Spain and by the wife of a king's son.

INFANTICIDE, in-făn'ti-sid, the murder of a child born alive, as distinguished from abortion, which is the destruction of the fetus in the womb. In primitive societies the origin and the aims of infanticide are generally impossible to discover, but are often related to the existing food supply as well as to various religious and social taboos. In civilized societies the causes of infanticide include the facts that a child is unwanted and that the shame induced by a dread of the social disgrace attaches to mothers of illegitimate children. The sanctity of human life, from its beginning to its close, is a maxim of modern civilization, except during "total" war and in certain dictator-governed or Communist-controlled countries, and the law treats as a murderer whoever performs infanticide.

INFANTILE PARALYSIS. See POLIO-MYELITIS.

INFANTRY, in-făn-trī, that branch of an army which is trained, equipped, and organized to fight on foot. Modern infantry may be transported to the battle area by aircraft, ship, train, trucks, or armored personnel carriers, but it normally assaults enemy positions or defends against an enemy attack on foot. Infantry forms the backbone of any army and comprises the bulk of the combat arms. It is the arm of close combat in that it physically engages the enemy. In offensive warfare it has the task of closing with the enemy and destroying or capturing him. In the defense it denies selected localities to the enemy and destroys him by counterattack.

Arms.—Infantry can fight on any terrain and is more independent of weather conditions than any other service or arm. Through the centuries, infantry was armed with sword, pike, and musket. Modern infantry is armed with rifles, bayonets, automatic rifles, machine guns, mortars, grenades, antitank weapons, recoilless rifles, flame throwers, explosive charges, tanks, and assault guns. Prior to World War I, the majority of the firepower of infantry was furnished by the rifle. This proved far from sufficient, and with every year of the war new weapons were added to the infantry units. In modern infantry divisions only about one third of the soldiers are riflemen.

Support.—Infantry by itself is capable of only limited independent action utilizing its own weapons. For decisive action it must be adequately supported by artillery, combat aviation, missiles and rockets, engineers, and tanks. Thus, infantry rarely fights alone. For the most part, it participates as part of combined arms teams, such as the infantry-tank team and the infantry-artillery team.

Organization.—Combat troops of all fighting arms are organized, with service troops, into in-

fantry divisions. Each division is commanded by a major general. The supporting arms and services assist the infantry in the accomplishment of its mission. Infantry divisions in most armies consist of three regiments, or brigades, of three battalions each. The regiment is commanded by a colonel, while a lieutenant colonel commands a battalion. Each battalion consists of three rifle companies, commanded by majors or captains. Each company consists of three platoons, commanded by lieutenants. The triangular nature of the organization is completed with each platoon being composed of three rifle sections or squads under the command of sergeants and corporals. The United States Army departed drastically from the triangular concept in 1957. It reorganized its infantry division into five battle groups. (See section on *United States Reorganization*.)

HISTORICAL DEVELOPMENT

Early Infantry.—The history of warfare is largely the history of the infantry. Except for a relatively short period in the Middle Ages when the mounted warrior was supreme, the infantry has been the basic arm, the winning of wars being determined by the actions of the infantry.

At the dawning of civilization man first fought as an infantryman. He resorted to stones and clubs and defended himself by building huts and surrounding them with stakes. Early organization consisted chiefly of loose groupings of individuals. Organization for war has been changed through the centuries by the development of new weapons. Similarly, tactics are dependent upon the weapons with which the infantry wages its battles. Thus, bronze and iron weapons replaced clubs. The result—new organizations and new tactics.

The earliest known national infantry was the Egyptian light infantry. Some of its members carried swords, while others were archers and slingers. Soldiers of the Egyptian heavy infantry carried large wooden shields for protection and were armed with spears six feet long.

Greek.—The Greeks amassed their power and accumulated their wealth by war, and the Greek armies consisted almost entirely of infantry. In battle the Greeks after the mid-4th century B.C. relied upon an infantry unit called the phalanx, a large group of infantry closely grouped together in a box formation and armed with a deadly spear, some 21 feet long. The first five ranks held their spears in horizontal position as the entire phalanx advanced and engaged the enemy. This formation offered little opportunity for maneuver, but was successful because of the tremendous shock effect that it had on the enemy.

Roman.—With the passing of the Greeks, the Roman Army, an infantry army, became supreme. The basic unit was the flexible legion, which consisted primarily of infantry. The legionary infantry was armed with shields, body armor, and a short heavy spear or javelin; however, the primary weapon was a double-edged sword, 20 inches long, that was used for thrusting. In Gaius Julius Caesar's (100?-44 B.C.) battles, the legion moved into the attack at a walk, in lines 8 or 10 feet deep. When it reached within 100 yards of the enemy, it took up the charge. Javelins were thrown at 15 yards, and then the Roman infantry assaulted with their deadly swords. The men in the rear continued to throw javelins at the enemy and moved in with the sword only to replace friendly casualties. The resultant havoc created by the Roman sword caused the aftermath of the

battlefield to be called the goriest sight in all history. The Roman infantry was supreme because of discipline, promptness in making required improvements, and care in selection, training, and exercise of the individual soldier. Discipline was lost under a succession of weak and profligate emperors. The legions deteriorated to such an extent that the Gothic cavalry from the East slaughtered the Romans at Adrianople (Thrace) in 378 A.D. After this battle, cavalry dominated warfare and the infantry declined into impotency. Adrianople heralded the end of the Western Roman Empire and the onset of the Dark Ages.

Medieval Infantry.—The Swiss pikeman and the English longbow man restored the infantry as the basic arm of battle and relegated cavalry to a supporting role. The Swiss infantry was the finest in Europe for centuries, because of its drill and equipment, and the fighting character of the soldiers. Swiss infantry victories in the 14th and 15th centuries showed that the day of the mounted knight was waning. The English annihilated a numerically superior mounted French army at Crécy (France) in 1346 by using the longbow, a bow six feet in length, capable of delivering two shots a minute with great accuracy at a range of 200 yards. French cavalry were slaughtered by the longbow much as were the Burgundian cavalry who attacked the massed pikes of the Swiss infantry at Grandson and Morat (Switzerland) in 1476 and at Nancy (France) in 1477.

Firearms.—The doom of mounted knights was sealed forever with the advent of firearms. Infantry regained the universal esteem and importance that it enjoyed in ancient armies and that it enjoys today. Early firearms were handguns consisting of barrels lashed to a stick and fired by a match. The Swiss at Morat (June 22, 1476) had over 6,000 handgun men to support their pikes. The next development was the matchlock harquebus, the forerunner of the musket. In 1540 a small harquebus two feet long with a curved handle was developed. It was called the pistol. In 1570 the musket began to replace the harquebus. It was provided with a matchlock that fired the charge by bringing a match in contact with gunpowder in the pan. The musket was so heavy that a forked rest was required to support it.

Early Modern Period.—Gustavus II (Gustavus Adolphus) of Sweden (r. 1611-1632) developed modern infantry organization and tactics. He borrowed from Maurice of Nassau, Stadtholder of the Dutch Republic (1587-1625), and from the Dutch.

Swedish Infantry.—Gustavus' battalions consisted of 4 companies, each with 54 pikemen and 72 musketeers. Swedish infantry attacked in six ranks that were divided into two firing lines, three files deep. Each musketeer hastened back to the rear to reload after firing, thus maintaining a continuous fire. The three-deep firing line of Gustavus survived two centuries, until the breech-loading rifle caused it to be replaced.

Firearms.—During the 17th century the firelock gradually replaced the matchlock as the infantry weapon. A charge of infantry no longer meant a collision of forces with pikes engaged. It meant instead a fire fight at close quarters until one side retreated. Pikemen were gradually abandoned because little use was found for them. The bayonet was devised to replace the pike. It was designed initially to assist infantry in fighting cavalry. Another development produced grenades, which were used to considerable success by infan-

try during the sieges of the Thirty Years' War (1618-1648).

Prussian Infantry.—The pattern of excellence for infantry was next established by Frederick II the Great of Prussia (r. 1740-1786). He planned his battles as a series of complicated maneuvers which required constant practice. He discouraged open fighting and had mechanical precision as his aim. This precision was of great importance in rapid loading and firing. Frederick's tactics were much copied, but rarely with the same success. Those who copied did not realize that it was the precision created by repetitious drill, and not the tactics per se, that led to Prussian victories. Frederick closed the era of linear tactics. This was proved when Maj. Gen. Edward Braddock, emulating Prussian drill procedures and following the Marlborough (John Churchill, 1st duke of Marlborough) type of fighting, was soundly defeated on the Monongahela River near Pittsburgh, Pa., in 1755 by the French and Indians, who employed mobile and flexible infantry tactics.

American Colonial Infantry.—American colonists adopted the tactics of the Indians by organizing units of light infantry or rangers. A compromise, which was between the rigidity of Braddock and the fluidity of the Indian, was subsequently adopted. During the War for Independence (1775-1783) the Americans took advantage of the available concealment and, utilizing flexible tactics, defeated some of the best regiments that Europe could muster. The precise Frederickian drill and formations had little effect against such tactics. This open-type fighting experienced by the British during the American Revolution created a profound effect upon Napoleon I (r. 1804-1815).

French Infantry.—French troops under Napoleon made use of small columns of infantry for maneuver and assault and of deployed lines for firing. Napoleon achieved great success against massed formations, employing such tactics in his earlier battles. But as the years of war continued and the caliber of the French infantry was reduced by the costly attrition, he resorted to greater use of masses instead of the light speedy open-order lines of earlier days. Napoleon's infantry was armed with the musket and bayonet. This latter weapon was given added emphasis, because Napoleon was a great believer in using the bayonet for the final charge of the French infantry.

American Civil War.—The Civil War (1861-1865) developed a system of advancing by rushes, with half of the men rushing and lying down to avoid losses and the other half firing to reduce the enemy fire. The difficulties inherent to this means of infantry advancing were that the men had to stand to load their muzzle-loading weapons, and it was difficult to make men advance once they were in the prone position. The actions were almost always decided by infantry fire. Bayonets were rarely used. The war showed the importance of looser fighting formations, the necessity of advancing by rushes, and the need for increased use of entrenching tools.

World War I.—Early in World War I (1914-1918) advances were made by infantry in lines of skirmishers or by staggered platoon columns. The deadly effect of the machine gun forced the interval between infantrymen to be increased from one to five paces. This made control of the men by the squad leader difficult.

Tactics.—The old system of advancing by

rushes was abandoned, because it was almost impossible to make men rise from the prone position and advance in the face of machine-gun fire. The machine gun produced a more deadly fire than could an entire company equipped only with rifles. A line of skirmishers offered the ideal target to the machine gunner. To counteract the effect of the machine gun and to reduce the exorbitant casualties which occurred in the initial stages of the war, new tactics had to be developed. The result was a reliance on tremendous artillery concentrations, the use of smoke to hinder enemy observation, and the employment of infiltration tactics. The infantry altered its procedures and abandoned attacking in long lines, shoulder to shoulder. Instead, it attacked by squads and platoons, utilizing the ground for all possible cover and protection. Each unit moved forward regardless of the progress made by units on the flanks. Enemy points of resistance were bypassed. The uneven progress of attacking infantry allowed men of supporting units, who were advancing behind leading elements of an unchecked unit, to fire into the flanks of the bypassed enemy. Tactics thus consisted of infantry units moving forward, first one unit and then another, wherever the enemy's resistance proved weakest. Reserves were committed to exploit success and not to reinforce or to redeem failure. Gains made were thus exploited by dispatching reserves through the points of breakthrough.

Support.—World War I was a static war of trench warfare with complicated networks of barbed-wire entanglements. The infantry had to rely on supporting arms to a degree never before experienced. The success of the defender's machine guns led to the development of the tank by the British. The slow-moving early tanks were capable of moving against enemy machine guns. They were used with success despite the numerous mechanical breakdowns that occurred. Mortars and small howitzers became organic to infantry units for close support. Dependence on strong artillery support for survival on the battlefield became mandatory. Infantry divisions were organized during the war to meet the exigencies of trench warfare. Half of the infantry of each division held the line, while the other half rested; thus, the infantry division consisted of two brigades, each having two regiments.

World War II and Korea.—The period between the world wars was one of improvement in the means of transportation both in the air and on the ground. Tanks and aircraft played a prominent role in the minds of military planners, with the result that armored (tank) and mechanized divisions were formed early in World War II (1939-1945). The infantry of World War II was also a modern force capable of performing at rapid speeds, being dropped by parachute, or landing in special amphibious craft on well-defended shores. All armies of World War II contained large amounts of infantry. The Russian and the German armies each had several hundred divisions, while the British, Japanese, and Chinese armies had somewhat less. The United States Army had 78 infantry divisions, 5 airborne divisions, and 16 armored divisions. In addition there were 6 Marine divisions, essentially infantry divisions, but specially trained for amphibious warfare.

Mobility.—The infantry fighting in World War II and in Korea (1950-1953) was similar to that of World War I, but differed in the mobility of the infantry. The foot soldier had organic ve-

hicles which transported him to the battlefield. Forced marches, long a characteristic of trained infantry, were rarely utilized. Infantry units were not limited to movement by foot, except as a last resort, when, because of difficult terrain or lack of transport vehicles, there was no other way to move. The force with inferior mobility was the defeated force. The bypassed Japanese infantry in the Pacific fought with a determination and tenacity rarely seen. But with the cutting of their supply lines they were reduced to immobility and had to remain in static positions. This resulted in inevitable defeat.

Tactics.—During World War II and in Korea, infantry companies attacked in a manner similar to the so-called infiltration tactics used in World War I. In the triangular organization, a company commander usually attacks with two platoons in the assault echelon, keeping one platoon in reserve for commitment at a decisive place. Under the cover of artillery and mortar fire (which sometimes included the support of combat aviation and naval gunfire), the attacking platoons moved either in column or in a line of skirmishers with five paces between soldiers. Troops approached the enemy position rapidly, making the maximum use of covered and concealed routes, supporting fires, and smoke screens. A platoon not stopped by enemy fire pushed on regardless of the progress of adjacent units. When enemy fire was received, the infantry "hit" the ground and returned the fire, trying to gain fire superiority. When such superiority had been gained, the infantry continued to move forward by a combination of fire and maneuver. If superiority could not be gained, the company commander would commit the reserve platoon to approach the enemy from a new direction. Infantry attempted to get as close to the enemy as possible before the artillery and mortar fires were shifted because of the danger to the attackers. This shifting of friendly fires frequently occurred within 75 yards of the objective. In this position the troops were organized into a skirmish line, if they had not previously adopted such a formation, and moved the short remaining distance, rapidly delivering a heavy volume of rifle fire while moving. This assault was frequently conducted at a walk rather than at a run, because a network of enemy positions in depth had to be reduced by grenades, flame throwers, and explosive charges. In the early stages of the war, infantry-tank teamwork was poorly coordinated, but after improved training the attacking infantry normally assaulted an enemy position with the assistance of tanks. This made the infantry task much easier. Another development was the use of the flame-throwing tank. This weapon could spurt bursts of flame from 100 to 200 yards, eliminating the enemy or demoralizing him so much that little resistance was encountered. Current infantry assault tactics for most armies include increased reliance on supporting fires, the use of infantry-tank teams, and, in particular, the use of flame-throwing tanks to support the infantry in special operations.

Casualties.—World War II and Korea exacted high demands from the infantryman. The battles were really fought in the rifle platoons. In these platoons there were the heaviest casualties, because the riflemen engaged the enemy in close combat. It was on the members of the rifle platoons that the onus of war fell—they had the least statistical chance for survival. There was rarely shelter, beds, or safety for the rifleman. He slept

in a trench or a foxhole often filled with water. He fought without promise of either reward or relief. He fought because of the discipline that was instilled in him, pride, belief in cause, and because he did not want to "let down" his fellow infantrymen.

Behind each rifleman in the United States Army in Europe during World War II were 15 other soldiers supporting him. The infantry comprised less than 20 per cent of the ground and air forces of the United States in World War II, yet it sustained 70 per cent of the casualties. It sustained 90 per cent of the casualties among the United States ground forces. Figures for infantry of other armies were comparable.

Morale.—Because of these conditions, all armies adopted campaigns to publicize and to glorify the foot soldier. At the start of the war the newer fighting forces—the air forces and the tank units—received the plaudits of the press, with the result that few men desired to be in the infantry. As the war progressed, the role of the infantry was given the publicity which it merited. The civilian populace finally realized the importance of the infantry and the courage required of an infantryman. In the Russian Army, political commissars extolled the role of the infantry to the soldiers and indoctrinated them with the importance of their fighting. The United States Army adopted a special badge of merit and gave special pay to combat infantrymen to reward those who bore the brunt of the fighting. Recognition of the importance of his job aided the infantryman immeasurably in the performance of his arduous duty.

MODERN ORGANIZATION

Armored Infantry.—Armored infantry is that form of infantry that is part of an armored (tank) division. The technical improvements in the tank's mobility and firepower in the years following World War I introduced the concept of armored tactics and the organization of armored or tank divisions capable of great mobility and of rapid exploitation. Initial German tank divisions in World War II contained no accompanying infantry. This was found to be a serious limitation, because tanks alone had difficulty in reducing enemy positions prepared with antitank guns, mines, obstacles, and other barriers. Therefore, mechanized infantry that could move at the same speed as the tanks was added to the armored division. Personnel carriers that gave the infantry some degree of protection were subsequently developed. The initial ratio was three tank units for every infantry unit. This proportion was found to be wanting in infantry. It was later changed to two to one, and finally to one for one. Armored divisions now contain equal amounts of tank and infantry units. (The United States division contains four tank battalions and four armored infantry or rifle battalions.)

Mobility.—Armored infantry is completely mobile. Each squad has its own armored personnel carrier, a fully enclosed, full-tracked, armored vehicle giving protection from small arms fire and shell fragments. Armored infantry usually assaults enemy positions dismounted, but it is accompanied or supported by tanks.

Flexibility.—Flexibility of organization is the most important aspect in the employment of armored units. This makes them capable of being readily adaptable to ever-changing battlefield conditions. Armored infantry rifle companies operate

either as a part of their own battalion or attached to a tank battalion. Similarly, rifle platoons operate with their own company or attached to a tank company. Thus, infantry and tanks are normally formed into combined arms teams at the platoon, company, and battalion level. Depending on the mission, some teams are tank heavy and some are infantry heavy. Infantry-weighted teams are used to attack in cities, against prepared positions, in dense woods, and in other areas not conducive to rapid movement by tank-weighted forces.

Airborne Infantry.—A new tactical development during World War II that resulted from mechanically sound aircraft was the vertical envelopment. Infantry was transported to the combat zone by parachute, gliders, and assault transport aircraft.

The Russians were the first to mass-train paratroopers. As early as 1935 the Soviet Army had one trained parachute infantry battalion. The Germans quickly organized parachute units and used them with limited success in the attack on Norway in 1940. The German airborne assault on Crete in 1941 was more successful. A parachute battalion captured key airfields on which troop carriers subsequently landed. Gliders were also used at Crete, but these craft suffered such severe damage in landing that the Germans did not use them again in an assault role.

Great Britain and the United States also developed airborne units. The British organized two divisions in late 1941. Each consisted of one glider brigade and two parachute brigades. The United States ultimately organized five such divisions. The largest operation was the attack of the first Allied Airborne Army into the Netherlands in 1944. The air armada carrying this force of over three divisions consisted of nearly 1,500 transports and 500 troop-carrying gliders.

Tactics.—Early airborne operations in World War II amounted to little more than surprise raids by parachutists. The infantry in the drop zone was vulnerable to enemy counterattacks, particularly by tank forces. It was found necessary to supply the initial lightly armed forces with heavier weapons and to develop a battle plan enabling them to link up quickly with friendly ground forces. The tactics developed for the airborne infantry involved landing behind well-entrenched defenders, cutting supply lines, disrupting reserves, and forcing enemy pressure away from other friendly units. The usual operation was called a link-up. It involved a landing behind enemy lines and an early juncture with friendly surface forces. The initial objective of parachute infantry was to secure landing sites, where gliders and aircraft could land heavy weapons and equipment in the airhead. This gave the airborne force a better chance to defend itself against counterattacks until the link-up with friendly forces was effected. Once landed, however, the airborne infantry fought as conventional infantry. In fact, the only difference between airborne or armored infantry and any other infantry is the means used to get it on the battlefield.

Transport.—Gliders fell into oblivion because they were easily damaged, immobile on the ground, and difficult to navigate. In addition, their load capacity was limited. They were replaced by newer types of aircraft that were capable of landing in relatively small areas.

All modern infantry can be transported by air. The airborne division differs from the regular infantry division in that it can be landed by para-

chute. Training in air loading and air landing is a prerequisite of all infantry.

The development of the helicopter has caused added emphasis to be given to the vertical envelopment tactical concept. The difficulty in parachute operations was the relatively long training period required, dispersion in the drop zone, lack of heavy equipment to combat enemy counterattacks, and lack of secrecy. Air movement by helicopter requires little or no extra training on the part of troops; it is exact, as far as landing in the desired area is concerned; and it facilitates evacuation, if necessary. However, helicopters are vulnerable to enemy fire and are limited in range. Consequently, future operations involving airborne infantry will still require some movement of troops by parachute. But this movement will be less than experienced in World War II.

Soviet Infantry.—Divisional Types.—There are three basic types of divisions in the Soviet Army: tank, mechanized, and rifle. Of the estimated 175 line divisions, 110 are rifle (infantry) divisions (in the mid-1950's). The rifle divisions have motorized equipment, organic tanks, and artillery. Since World War II, considerable attention has been given to modernizing the equipment and the weapons of the Soviet infantry.

Organization.—Soviet organization of infantry closely paralleled that of the United States Army before 1957. The Soviet rifle division is organized on the triangular concept. It consists of 3 rifle regiments with about 2,500 men each, supported by an artillery brigade and a tank regiment. The tank division has relatively little infantry. It contains one mechanized infantry regiment and three tank regiments. The mechanized division is built around three mechanized infantry regiments, two tank regiments, and supporting artillery.

In the rifle regiments, there are three rifle battalions, each with three rifle companies organized into three rifle platoons. A mortar company, a machine-gun company, an artillery battery (company), and an antiaircraft artillery battery support the battalion, giving it a strength of 550 men. This is considerably less than the battalion strength of North Atlantic Treaty Organization (NATO) forces. Administrative and supply troops, such as ammunition bearers, drivers, and radio operators, are few in number, giving Soviet units less capability for sustained operations.

Weapons.—Modern Soviet doctrine includes the tactical employment of nuclear weapons. To develop such doctrine, numerous organizational tests have been conducted. No major overall changes have been made by the Soviets. The use of tactical nuclear weapons has made the importance of the infantry more manifest to Soviet leaders. Nuclear weapons have enhanced the part played by the foot soldier by raising his role to a new level. The Soviet Army infantry has been trained in means and methods of protection and in techniques of executing missions in the face of enemy nuclear weapons. New infantry equipment issued to Soviet units has improvements in mobility, firepower, and communications—all necessary for survival on the nuclear battlefield.

Tactics.—Soviet infantry attacks after thorough detailed preparations and thunderous artillery concentrations. Stress is placed on maintaining the momentum of the attack. Successive waves of troops moving forward relentlessly and with little regard to casualties produce assaults

that have a steam-roller effect. The result has been likened to a human sea directed against a chosen area in the enemy's defenses. The first wave bypasses strong points and strives to reach the objective quickly; the second wave reduces the bypassed strong points. Subsequent waves may be directed through the initial waves to maintain the momentum of the attack or may be directed to exploit success by flanking and encircling movements. The attacking waves are not mere skirmish lines, but have depth. The first wave of an attacking division frequently consists of three rifle battalions attacking over a frontage of one and one-half miles. These are reinforced by three more battalions. The second wave could then consist of the remaining three rifle battalions. Once the enemy defenses have been breached, the infantry destroys strong points in piecemeal fashion. As control becomes a complex problem, combat within the enemy's defensive position is the most difficult phase of the attack.

Soviet infantry defends in depth with a rifle battalion covering about one mile of frontage. Great reliance is placed on a powerful artillery effort in front of the main resistance zone. Counterattacks are stressed. Also emphasized is the ability of surrounded units to become self-sufficient and to break out of the encirclement.

The most significant change in the Soviet ground forces since World War II has been the great improvement in mobility and firepower. Armored personnel carriers are now in mass use, amphibious vehicles have appeared in large numbers, and helicopters are now widely employed. The Soviet Army arsenal features a new artillery system including field artillery, rockets, ballistic missiles of all ranges, and antiaircraft weapons of impressive mobility and effectiveness, together with a new family of tracked prime movers for their rapid emplacement and dispersal. The importance of armor-protected firepower on the nuclear battlefield has been recognized, and has resulted in the production of new amphibious medium and heavy tanks. Electronic equipment has been greatly improved, and modern communications equipment is in wide use throughout the ground forces.

Intensive training is employed to teach the troops to employ these new weapons under conditions of modern warfare. Soviet strategy and tactics have been modified to incorporate them. Current developments in Soviet tactics, weapons, and equipment reveal greatly increased emphasis on cross-country mobility, on mobile armored firepower, and on missile support.

Logistical support has been markedly improved by increased standardization of equipment and improved transport capabilities. It is now as mobile as the line divisions, and is believed capable of supporting them in every respect.

United States Reorganization.—The United States Army recognized after World War II that the use of tactical nuclear weapons would greatly alter tactics. It was faced with the problem of creating units and weapons capable of fighting a nuclear or a nonnuclear war. While the nonnuclear war was being waged in Korea, planners were developing an optimum nuclear battle force containing units capable of operating in widely dispersed formations, possessing increased mobility, equipped with organic nuclear delivery means, and having multiple means of communication and control.

Organization.—After numerous tests, the in-

fantry divisions were reorganized in 1957, and the triangular concept was completely abandoned. The reorganized divisions consist of 13,700 men as opposed to over 17,000 men in the older division. Yet the rifle or foxhole strength is increased. The basic infantry unit is a battle group of 1,400 men. Each division consists of five such groups. Each battle group now contains 5 rifle companies, each having 184 men. Each company contains three rifle platoons and a weapons platoon. The battle group is an integrated organization capable of operating semi-independently for short periods of time. In addition to rifle units, there is a combat support company providing organic heavy mortar support, antitank guided missiles, a ground reconnaissance capability (armored cavalry platoon), and ground surveillance radar. Engineer, medical, signal, administrative, and logistical support is furnished by the battle group headquarters company. Divisional units include a tank battalion, a reconnaissance battalion, and artillery with a nuclear capability in the Honest John rocket and the 8-inch howitzer. To increase ground mobility, two armored personnel carrier companies are organic to the division. These can transport one complete battle group or the assault elements of six rifle companies. The new division stresses flexibility of organization for combat and the need for formulation of mobile task forces tailored for specific missions. Each company is trained to have a motorized reinforced rifle platoon ready to move on 30 minutes notice to perform specific tasks. Movement by helicopter is emphasized, because it affords the greatest speed and freedom of action.

Reorganized Airborne Division.—The United States Army also reorganized its airborne divisions along similar lines. The airborne divisions consist of 11,500 men. Five airborne battle groups comprise the main infantry units. Each battle group has five rifle companies. To achieve complete transportability by air, tanks, antiaircraft, and heavy engineer equipment are not part of the division. This reduces the ability of the unit to maintain sustained combat for prolonged periods without augmentation. All personnel of the division are trained for parachute operations.

THE FUTURE OF INFANTRY

The stockpiling of thermonuclear weapons capable of yielding an explosive force equivalent to millions of tons of TNT (trinitrotoluene) has caused a small group of air theorists to declare that there is no need for the infantry or armies as part of the armed forces of the future. They hold that the existence of a strategic air force capable of prompt massive retaliation is the great deterrent to potential aggressors, but that, if war does come, the initial air attacks and counterattacks will determine the issue. Infantry advocates sharply disagree with this concept. Even if all-out nuclear war occurs—and this becomes less likely as nuclear parity between East and West approaches and the destructiveness of nuclear warfare becomes clear—the ultimate decision must be made by the infantry on the land. Infantry is the only force with the versatility required to gain control of the enemy's war-making potential: his land, people, and resources. The issues of war are decided on the battlefield regardless of whether this is the chief killing area. Decision in war is not obtained by counting the millions of dead or the number of devastated cities, but by subjugating the enemy force protecting the homeland.

Along with air and naval forces, the existence of combat-ready infantry forces by a nation or an alliance of nations, such as NATO, is an effective deterrent to potential aggressors. Their presence serves warning that aggression will be met on the land with force and that the aggressor must face the attendant risk. As the appreciation of all-out nuclear warfare becomes clear, the probability of such a total war decreases. Once war commences, the mission in the nuclear age is to localize the struggle, if possible, and to win the local war. If it cannot be localized, the mission is to win the all-out war. This can be accomplished only by infantry, supported by the other arms.

Every trouble spot, such as the Middle East, Indochina, Taiwan (Formosa), and Korea, has presented a special military problem. But these areas have had one common characteristic: any military action must be essentially a land operation.

The infantry of the future will be equipped with low-yield nuclear weapons and more effective nonnuclear weapons. It will be completely mobile, each unit having enough light, armored personnel carriers to carry all soldiers to the battle area as close to the enemy position as possible. To close with and to destroy the enemy in his defensive positions still will require the infantry to dismount from its carriers and to assault on foot. Infantry will be completely air transportable, to include all equipment and personnel. In a matter of hours, such a force could rapidly be transported by air to any trouble spot in the world. In addition, air vehicles will be used on the battlefield to preclude the necessity of negotiating difficult terrain and to assist in patrol- and raid-type operations in the enemy's rear. The battlefield will be fluid and, because of the increased lethality of weapons and the improved mobility of the infantry armies, may be smaller. The evolution of military weapons from the use of clubs to the use of tactical nuclear weapons has effected a tremendous change in the art of warfare. It has not altered the fact that man determines the final outcome of war. See also ARMY; TACTICS.

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INFECTION. See BACTERIA AND BACTERIOLOGY—*Bacteria of Significance*; CONTAGION AND CONTAGIOUS DISEASES; DISEASE, GERM THEORY OF; STREPTOCOCCAL INFECTIONS.

INFERIORITY COMPLEX, ɪn-fēr-i-ōr'ī-tī kŏm'plĕks, a feeling of personal inadequacy induced by continued failure to achieve self-esteem. Awareness of physical defects, of an inferior social status, of difficulties in learning the curriculum, or of incompetence in meeting the problems of daily living may give the individual a sense of being inferior to others. Such handicaps may actually exist or they may be wholly imaginary. Familiar symptoms of an attitude of inferiority are the following: withdrawal from competitive endeavors, lest there be another defeat; a wish to "debunk" others, thereby lessening the need to be self-reproachful; an undue response to compliments and flattery, which seem temporarily to ease the tensions caused by the feeling of personal incompetence; and unjustified concern over well-intentioned criticisms. The individual with a feeling of inferiority is likely to misinterpret the behavior of other persons as being slights and

disparagements. Bizarre delusions of being persecuted by teachers, employers, friends, and associates may develop.

Repeated experiences with failures, especially during the early years of life, weaken whatever amount of self-esteem a child may have developed. Tasks which challenge the normal child are avoided by the one who has inadequate self-confidence. A succession of low marks in school, rejection by schoolmates, expressions of disappointment by the parents, unfavorable comparisons with a brother or sister—these are experiences which would inevitably lead to an attitude of inferiority on the part of a child. Lacking the psychological resources of an adult, the child is unable to construct a sense of justified confidence with which to face the world. The alternatives, then, are: (1) to rebel against the frustrations and to incur the risk of being defined as an incorrigible child; or (2) to accept defeat and to feel personally inadequate as compared to others.

Since the urge for self-respect is strong, the individual may develop compensatory behavior. For example, unable to win favorable attention through real achievements, the person may become boisterous, act in a clownish manner, or boast of imaginary superiorities. In a futile effort to find constant reassurance that there is no need to accept inferior status, the person may overmagnify the importance of membership in exclusive groups, of minor titles, or of some peculiar abilities. The "compensating intellectual inferior," for instance, strives to impress others through his use of polysyllabic words. Perhaps he hopes that, unlike Mrs. Malaprop (see MALAPROP, MRS.), he has correctly pronounced them.

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INFERNO. See DIVINE COMEDY.

INFINITE, ɪn'fī-nīt (Lat. *infinitus*, unbounded, unlimited), in mathematics, a variable quantity which increases without bound or limit. In contrast with this, when a variable quantity decreases indefinitely, but never becomes zero, it is called an *infinitesimal*. Both of these concepts involve the idea of limits. For example, the quotient of a constant a by a variable x tends to become very large as x decreases to the value zero, and we write $\lim_{x \rightarrow 0} \frac{a}{x} = \infty$, which is read "as x

approaches zero as a limit, the value of $\frac{a}{x}$ increases without limit." In this sense the symbol ∞ (infinity) may be used to shorten a limit statement; but ∞ is an ideal number—it does not behave like an ordinary number in any sense.

In a series, like the geometric series, where each term is defined by a fixed relation to the preceding term, the number of terms is infinite. In geometry, a straight line may be considered as containing an infinite number of points, but between any two of these points there would be another infinity of points. Through any point may pass an infinite number of lines.

Many geometric ideas are simplified and broadened by postulating points, lines, and other geometric elements at infinity. Thus, two parallel lines meet in a *point of infinity* and two parallel

planes meet in a *line at infinity*. See also GEOMETRY, PROJECTIVE.

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INFINITE, in philosophy. By the Infinite is usually meant an entity which neither begins nor ends in time and space and whose powers are limitless and self-caused. With exceptions, for example, Plotinus (205?–270 A.D.) and Baruch Spinoza (1632–1677), the Infinite has been identified with God, and in Western religious circles has been described as a He who cares rather than an impersonal It. Poets, philosophers, and theologians have expressed belief in the Infinite and have insisted that only knowledge of and emotional dependence upon or absorption into the Infinite can assure human happiness.

Plotinus emphasized that terms of ordinary language cannot be applied to the Infinite or, in his terminology, to the One. Similarly, medieval philosophers insisted that statements about the Infinite must be interpreted negatively, that the sentence "God is infinite" asserts primarily that finitude and limitation and imperfection are not to be attributed to God. Mystics have therefore sometimes tended to describe God as Nothingness, a description which has led some philosophers to conclude that nothing meaningful can be said about God or the Infinite.

The Infinite has also played a role in metaphysical discussions. Indeed, some philosophers still consider the task of specifying the relation between the Infinite and ordinary objects of limited duration, extent, and power, hence referred to as finite, to be the central problem of metaphysics. Naturalists, believing that only finite objects exist, refuse to recognize this as a problem; other philosophers insist that it is either an unclear or an insoluble one. To avoid these conclusions, Georg Wilhelm Friedrich Hegel (1770–1831) suggested that the finite and the infinite be considered not as distinct entities or realms, but as part and whole. He suggested that finite objects systematically interrelated over time form a system or whole, understandable only in light of the Infinite. Many, however, do not consider Hegel's reformulation helpful.

Whatever their logical status, speculations about the Infinite have generated many historically important hypotheses about the universe and its structure. Of particular interest are those ideas, traced back to Plato (427?–347 B.C.) by Professor Arthur Oncken Lovejoy (1873–), which center around the thesis that God, being infinite and devoid of meanness, has made the universe as complete and full as possible.

Entities other than supernatural or metaphysical ones have frequently been considered infinite, in either number, space, or time. The ancient atomists, for example, believed that the number of elements is infinite, a view which, if we allow the substitution of "elementary particle" for "atom," has been contested by contemporary scientists.

Beginning with Anaximander (611?–547 B.C.), some pre-Socratic Greek philosophers theorized about the existence of *to apeiron* (the boundless). For some this meant the postulation of an aboriginal indeterminate stuff out of which, through a variety of processes, familiar objects are gen-

erated; for others it involved belief in an infinitely extended entity. Aristotle (384–322 B.C.) argued against the latter thesis, insisting that no actual, as opposed to potential, Infinite can exist. His teachings, coupled with considerations from Ptolemaic astronomy, convinced many through the medieval and early modern periods that the universe was finite and had definite boundaries. Renaissance thinkers, including Nicholas of Cusa (1401–1464), Giordano Bruno (1548?–1600), and Thomas Digges (d. 1595), who in part revived arguments by Lucretius (94?–255 B.C.), challenged this tradition, which was all but abandoned by the 18th century, due to the influence of Newtonian mechanics.

Many of these discussions overlooked the distinction made in contemporary relativistic models of the universe between finiteness and boundedness. According to these models, the universe is finite in the sense that it contains a definite finite number of cubic miles, but unbounded, in the sense that it has no end or frontier.

Recent astrophysical theory is related to another time-honored problem about the Infinite, that is, the temporal infinity or eternity of the universe. According to Professor George Gamow (1904–), a time may be specified for the beginning or creation of the universe; hence the universe did not always exist. Professor Gamow's and allied theories, which incidentally are not universally accepted, are relevant for dating the universe as we know it, a universe in which objects and processes obey specifiable laws. What preceded the universe in this sense cannot currently be decided on scientific grounds.

On general considerations, one may agree with Immanuel Kant (1724–1804) and many other philosophers that reason cannot decide between the thesis that the universe is eternal and its contrary that there was an absolutely first event.

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INFINITESIMAL CALCULUS. See CALCULUS—4. *Infinitesimals and Differentials.*

INFLAMMATION, in-flā-mā'shūn, the basic response of the animal body to any type of physical or chemical injury or bacterial invasion. This is the process by which the body, principally human, both resists and repairs damages caused by irritant forces: namely, heat, cold, radiation (X-ray, radium, or bomb blast), foreign bodies (a splinter), a bruise or direct trauma, chemical agents, electricity, pathogenic microorganisms, and, to a lesser extent, animal parasites.

The first clinical signs of inflammation are heat, swelling, and pain. Studies of blood vessel changes have been made by viewing through a cellophane or glass window microscopic sections of a living rabbit's ear, irritated by croton oil. The first reaction seen is the dilation of the arteries, veins, and capillaries, followed by a

rush of cells, particularly white blood cells, to the inflamed area. The force which summons the white blood cells has been called leucotaxine by Valy Menkin. Next the vessels are seen to release the white cells through their walls into the tissue space. Also released are certain portions of the plasma fluid, antibacterial toxins, large wandering cells, some red cells, and, later, small mononuclear lymphocytes. The polymorphonuclear leucocyte or ordinary white blood cell remains, however, as the foot soldier of the operation. Its duties include digestion of the invading bacteria by the process of phagocytosis. Many white cells are destroyed in the ordinary infection. Their debris forms the pus in the inflammatory exudate.

A classical example of an inflammatory change is the skin boil. Here the invading organism, the staphylococcus, causes the redness and swelling. The leucocytes are sent out to destroy the bacteria and to help to form the pus or core of the boil. At the same time the body is making an effort to rebuild the damaged tissue by the deposition of fibrin walls and the formation of fibroblasts. This step walls off the inflammatory area from the rest of the body and builds up a mechanical pressure inside the boil, which in turn ruptures toward the outside skin and drains. Thus healing is accomplished. It is an acknowledged fact that the bone marrow, when called upon by an inflammatory change anywhere in the body, will double or triple the production of leucocytes. This is why the normal white count, which runs between 5 and 10 thousand, may reach 20 or 30 thousand in, for example, an acute appendicitis, meningitis, or pneumonia.

Other cells in the areas of inflammation include macrophages, lymphocytes, and plasma cells. The macrophages are the large wandering cells with large arms (pseudopods) often originating in two or more directions to engulf foreign bodies, dead bacteria, and debris. The lymphocytes increase in number as the inflammation becomes more chronic, as in syphilis, sarcoid, or tuberculosis. Plasma cells, a type of lymphocyte, are seen in the exudate of chronic joint inflammations.

Inflammation is the first fundamental change of all pathological processes in the body, and is the key to both resistance and repair. The surgeon depends upon it to heal his operations. The physician would be powerless without its help, despite antibiotics, antisera, and vaccines which might be available.

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INFLATION AND DEFLATION. Introduction.—Prices of nearly all goods and services have moved, at times violently, upward and downward in recent history. Most of the sharp increases in general prices have been associated with major wars. This was true of the price peaks attained in the United States at the end (or soon thereafter) of the War of 1812, the Civil War, World War I, and World War II. Price declines followed these spectacular upswings, but usually they fell short of the prewar levels of prices. Between wars, however, prices dropped to very low levels in the depressions of 1849, 1896, and 1932. Since World War II prices declined briefly in 1949, rose moderately during the Korean War, and then declined slightly to a relatively stable level until mid-1956. Subsequently, the main pressure seemed to be in the direction of rising prices. Other nations have

experienced similar price changes, and particularly since World War II have encountered rising price trends.

Meaning of Inflation and Deflation.—

In popular usage inflation means rising general prices and deflation, falling general prices. Greater precision of definition, however, is required in order to understand the complex movements of prices, general price changes and their effects, and the methods of controlling some kinds of inflation and deflation. First is the distinction between open and suppressed (or repressed) inflation that became significant in World War II and thereafter. *Open inflation* simply means an upward movement of the price level. *Suppressed inflation* refers to a situation in which an upward movement of the price level would occur if maximum limits established by law for prices, wages, rents, and the like were removed. Several kinds of evidence indicate this potential upward movement of prices. Long queues of shoppers waiting to make purchases, often without success, are common sights. This is true when stocks of goods available are much less than the amounts consumers are willing to buy at controlled prices, and are sold on a first-come-first-serve basis. To avoid some of the frustration and loss of time in shopping queues, rationing laws commonly are used that provide maximum limits for the amounts of certain things purchased per person per month, or other specified period. Also, government subsidies are paid sometimes for making certain essential commodities available at prices less than cost. And lastly, the prevalence of black markets in which buyers obtain illegally things at prices often greatly in excess of those stipulated as the maximum in legislation is definite evidence of suppressed inflation.

A second distinction relates to open inflation in which certain features of an upward price movement may vary significantly. One is the relation of total output in the economy to rising prices. If rising prices are encouraging an increase in output—a basic function of a price increase in a competitive market system—and thereby bringing about a fuller utilization of the labor force and production facilities, the situation may be termed *gross inflation*. Once the capacity of the economy is fully utilized, rising prices cannot bring forth additional output but only ration it to the highest bidders, and this situation is referred to as net or *pure inflation*. Another important feature is the rate and duration of an upward price movement. For instance, a gradual rise in the price level over a long period with approximately full utilization of capacity might be held by increasing productivity to an average of one per cent per year—a situation of *creeping inflation*. On the other hand, a sharply accelerating rise in the price level with approximately full utilization of capacity may within a year or two render money practically worthless and compel resort to awkward barter transactions—a situation of *galloping inflation* or *hyperinflation*.

Third, deflation is not the exact opposite of inflation. It is true that deflation involves a downward movement of prices, but usually any appreciable deflation is associated with increasing unemployment and lessening of output. This happens because a general decrease in demand for many goods and services lowers the price of some goods and services in competitive markets rather quickly with little change in output, but in monop-

olistic markets prices and wage rates tend to be maintained by reducing output and employment. On the other hand, prices can be raised much more readily than lowered, and although rising prices often increase output and employment (the opposite of deflation), one kind of inflation—pure inflation—does not. Moreover, in the process of deflation there is no counterpart to suppressed inflation.

Measurement of Inflation and Deflation.—

It is a relatively simple matter to describe inflation and deflation in terms of changes in the general price level and related conditions of output and employment. The measurement, however, of price-level changes and production-capacity utilization is difficult and unprecise—a circumstance, as indicated later, of considerable importance in controlling price-level changes. The level of prices, monthly and yearly, is expressed as an average which obviously cannot include all prices in such an average, so only a representative sample of prices is obtained. Not all prices move in the same direction at the same time—the price of automobiles may rise \$300 and the price of meat may fall 10 cents per pound. The influence of these diverse price changes of two unlike commodities on the price level depends on the relative change in the two prices and the importance or weight assigned to them in the price average. And lastly, over a period of time new products appear and old ones decline in importance, so that a revision of some items included in the average is necessary. When the prices of some commodities are eliminated and others are substituted the average is not measuring the prices of an identical group of items over a long period. However, a careful revision involves less inaccuracy in measuring price-level changes than continuation of items whose prices are no longer of any or very little significance.

Two examples of such averages for measuring price-level changes are the *Consumer Price Index* and the *Wholesale Price Index* of the Bureau of Labor Statistics of the United States Department of Labor. Other nations prepare and publish similar indexes. The *Consumer Price Index* shows changes in weighted average retail prices of selected goods and services (about 300 items: foods, apparel, housing, and other primary service items) considered important in the purchases of city wage-earner and clerical-worker families. These moderate-income families, which represent a large majority of people living in urban areas and a large portion of the total population, spend more on food than on apparel and more on housing than on service items. An average price change for foods, then, is more important in the cost of living than an equal change for apparel. Accordingly, weights are assigned to the different items in the index on the basis of their purchases by such families in 1952. The average level of prices of the 300 items, weighted to measure the purchases of middle-income groups, for the three years 1947–1949, is used as the base period and is designated as 100. When any other year's weighted average is divided by the average for the base period, the ratio (multiplied by 100) gives the relative price change, for example, 140 means that the average retail price is 140 per cent of the average price of the base period. Averages of prices for other periods are related proportionately to the base period of 100. The *Wholesale Price Index* uses the same years as a base period. Its monthly index includes prices of nearly 2,000

basic commodities charged by manufacturers or producers, or quoted on commodity exchanges weighted according to their sales importance in 1947.

The purchasing power of the dollar is measured in terms of both price indexes. The dollar buys less of the same commodities when wholesale prices rise and more when they fall. Thus, an index of purchasing power is the reciprocal of a price index. For example, a wholesale price index of 150 means that the price level increased 50 per cent as compared with the base period, and the reciprocal of this index, 66.7, means that the purchasing power of the dollar decreased 33.3 per cent, as compared with the same base period. Such changes in the value of the dollar for wholesale purchases are likely to reflect roughly its value for many other business costs. Also, the purchasing power of the dollar varies reciprocally in terms of retail prices paid by a representative group of consumers for the same selection of typical goods and services. These changes in the value of the dollar reflect generally for many families, changes in the cost of living for a specified standard of consumption—not higher or lower costs for raising or lowering one's standard of living. Both measures of the purchasing power of monetary units are commonly used, but often more emphasis is given to wholesale price indexes. This is preferred because of their broader coverage as compared with consumer price indexes, less difficulty in obtaining wholesale prices of things with and because of rather definite specifications, and the occasional use of government subsidies to depress arbitrarily the retail prices of some essential consumer goods.

Another important measurement consists of estimating the production capacity of an economy and its degree of utilization. This is important because pure inflation is defined as rising prices after full capacity output is reached, and a vital part of the analysis of the effect of inflation and deflation (beneficial or not) hinges on the degree of production-capacity utilization. Estimates of capacity are almost entirely in terms of the total labor force. Only for a few basic industries are there some statistics of plant capacity, but the amount of employment and unemployment in the economy is reported frequently. For instance, monthly sample surveys (Bureau of the Census, United States Department of Commerce) provide estimates of civilians 14 years of age or over who are employed (that is, at work, or with a job but temporarily absent), or unemployed (i.e., not working but seeking employment). Other civilians in this age group of the population are classified as "not in the labor force." The sum of the employed and the unemployed constitutes the civilian labor force. Usually the percentage of unemployment is used to indicate the degree of labor utilization and the approximate partial or full-capacity operation of the economy.

Explanations of Inflation and Deflation.—

The association of serious inflation with major wars is not accidental. Aggregate demand or total expenditures (consumer spending, business investment, and government spending) rise much more rapidly than output during a war period. This is particularly true of civilian goods which are likely to decrease in output as soon as war mobilization shifts substantial amounts of manpower into the armed forces and into industries producing war goods. The additional government

expenditures tend to expand output and total income (wages, salaries, profits, and the like) especially if some unemployment previously existed. However, nearly all of the additional government expenditures goes to a portion of those formerly employed in producing civilian goods and services in order to pay for war goods and services. This shift in the use of the labor force soon reduces the output of civilian goods, but maintains and increases total income. If the eliminated civilian goods have a value at prewar prices of say, \$50 billion, then a potential inflationary gap of approximately that amount exists. In other words, with income not reduced, the \$50 billion of income formerly spent on these eliminated items is available to be spent on the reduced output of civilian goods. When this gap is not closed by additional government taxes which absorb the excess income, or by government measures which prevent its being spent (price controls and rationing), prices rise rapidly.

Usually it is not feasible for a government in wartime to raise taxes quickly and sufficiently to absorb the excess income. Moreover, the net effect of new taxes on curbing spending is likely to be substantially less than the income diverted to government. Some individuals are likely to pay part of the new taxes by reducing the amount that otherwise they would have saved, and corporations are likely to set aside less for reserve. Consequently, governments resort to borrowing in order to finance a major portion of war expenditures. Such borrowing, of course, could close the inflationary gap, over and above the amounts diverted by new taxes, if the purchases of government bonds cut spending by a like amount. Many individuals may spend less and save more in order to purchase government bonds, but generally these individual savings reduce consumer spending only moderately, and are insufficient to satisfy quickly the government's needs for funds. To meet this emergency, modern governments, instead of printing additional paper currency, borrow heavily at banks in order to finance a large part of their war expenditures. In either case the inflationary result of more money and additional expenditures is approximately the same. The banks extend credit to the government in the form of demand deposits (checking accounts) in exchange for bonds. Government checks drawn against these deposits pay for goods and services purchased by the government, and those receiving government checks are likely for the most part to deposit them in their bank accounts and write checks to pay for what they buy. If some additional currency is needed by the commercial banks to cash checks, it may be obtained by drawing on their excess legal reserves and by their selling government bonds to the bank or banks authorized by the government (that is, Federal Reserve banks in the United States) to issue currency. Such banks may use in whole or part these bonds as a reserve against the issuance of additional currency. Furthermore, many firms receiving government contracts to furnish war goods borrow from the banks in order to convert and expand production facilities for this purpose. Thus, the total inflationary gap is the sum of government expenditures and business investment expenditures in excess of tax revenues and normal savings.

In a war period if direct controls (that is, legal limits on prices, wages, consumption, and the like) are not imposed, prices of civilian goods rise rapidly because of additional income that

can be spent on a reduced output. This generates a pressure for increase in wages and other incomes in order to offset the price rise of cost-of-living increase and to maintain approximately the previous level of consumption. Wage and other income increases are deemed necessary to provide incentives for production. For the most part these income increases do not help the recipients because no more goods can be made available, prices continue to rise—pushed upward by higher wage and other costs, and pulled upward by the expenditure of higher incomes. Costs of goods and services purchased by the government increase, and although tax receipts increase, additional borrowing is necessary to finance war expenditures. This inflationary spiral may continue until money becomes practically worthless, that is, prices may rise to thousands or millions of times prewar levels (for example, the German mark and the Russian ruble after World War I). On the other hand, at the end of a war, government borrowing to cover budget deficits may cease, and production of civilian goods may increase rapidly. These changes may halt the inflationary spiral at price levels anywhere between 50 and 1,000 per cent above prewar levels, and may bring about deflation (for example, the United States and the United Kingdom in 1920).

If direct controls are imposed, the basic shortage of civilian goods is not altered. Materials can be allocated to war industries and restricted for civilian production without substantial increases in prices. Maximum prices can be established for civilian goods at approximately prewar levels, and rationing controls can limit per consumer the amount of many essentials purchased so that the reduced output is shared more equitably. Such rationing and price controls of consumer goods prevent a sharp rise in the cost of living which makes feasible some control of wage increases. The cost of government purchases is curbed and less borrowing is necessary. Thus, the inflationary spiral may be largely suppressed. However, at the end of a war the inconvenience of direct controls to many consumers, their hampering effect on the resumption of peacetime production, and their cost of administration may lead rather quickly to their elimination. Prices may then rise moderately, although government expenditures are reduced and government borrowing is discontinued, largely because of greatly increased consumption expenditures and business investment. Unable to buy many things during a period of suppressed inflation and forced to save, consumers expand rapidly their purchases by using accumulated savings (for example, currency, bank deposits, and government bonds), by spending more and saving less of their current income, and by using installment and other kinds of credit. Expenditures for business investment are made to convert plant and equipment to peacetime uses, to buy new equipment, and to build up depleted inventories of raw materials and finished goods. These investments are financed mostly by accumulated savings and by borrowing at the banks. If the peacetime output of goods increases promptly in response to rising prices, the pent-up consumer demand is soon satisfied and further inflation is stopped.

Deflation is likely to follow a war period of open inflation. In this situation during a war prices rise so much that government expenditures and borrowing are excessive as compared to the war-production effort. At the end of the war

government expenditures fall rapidly, government borrowing is curtailed or eliminated, and prices begin to decline. Moreover, the open inflation of the war period reduces the ability and incentive of individuals to accumulate liquid savings (for example, currency, bank deposits, and government bonds), and hence, there is no appreciable increase in consumer expenditures at the end of the war to replace the decrease of government expenditures. And lastly, the initial decline in prices discourages business investment. Total expenditures, and consequently incomes, decline which reinforces the price decline, and the latter has further discouraging repercussions on investment expenditures. This is the deflationary spiral.

Deflation in an interwar period is sometimes complex in origin and difficult to explain. For instance, the great deflation or depression of the 1930's is explained in terms of several major "causes" and many minor ones. There is no complete agreement among experts concerning the explanation. Certain general features, however, seem to be typical of such peacetime, severe deflations. First of all, aggregate demand or total expenditures decline, not because of a cut in government expenditures and the development of a budget surplus, but because of a decline in business investment which creates unemployment and reduces income. Second, this initial decline in expenditures and in some prices (certain noncompetitive prices may be maintained or lowered very little by reducing output and laying off workers) generates further deterrents to investment expenditures until the construction and equipment industries practically cease to operate. Third, consumption expenditures decline, although prices are falling, because of increasing unemployment and the shrinkage of income. Eventually a bottom to the decline is reached when many individuals are using practically all of their current income for consumption expenditures in order to live, others are using up accumulated savings to avoid drastic drops in their consumption, and still others are depending on assistance from relatives, friends, and government to maintain a minimum level of consumption. When the decline of consumption expenditures is arrested, prices stabilize and soon rise because of the resumption of business investment, perhaps augmented by an increase in government expenditures and borrowing. Fourth, the rise in investment occurs because eventually some plant capacity becomes unusable and obsolete and new equipment is needed for current operation and for prospective replenishment of depleted inventories.

The falling off of business investment at the beginning of a decline in some prices seems to be the origin of the ensuing deflationary spiral, but the probable conditions responsible for it are multiple and not single. Just prior to the break in prices it is probable output, employment, and income may have been increasing because of technological improvements in certain industries and profitable innovational opportunities which encouraged directly some investment, and also indirectly induced investment in other industries. Part of this investment expansion is likely to be financed with bank credit. Total expenditures rise, prices rise, and the demand for labor increases wages. Gradually profitable investment opportunities become fewer in number and the banks become less willing to extend credit. Rising interest rates, wages, and costs of capital equipment narrow amount or rate of profit. In a few

industries expansion of output may lower a few prices although most prices are still rising. Because of the upward trend in prices, many speculative purchases of commodities, securities, and real estate are made, in part with bank credit, in anticipation of further increases. And lastly, although consumption expenditures increase with rising personal income and prices, the customary percentage of income saved means a rising volume of savings. Thus, when the inducement to invest weakens and the rate of investment expenditures lessens, intended savings will exceed intended investment and the excess will not be returned to the flow of income. The shrinkage of income retards the sale of consumer goods, results in unexpected accumulation of inventories, and depresses many prices. A process of liquidation begins—an increasing pressure to sell inventories, securities, real estate, and the like in order to restrict losses and to meet debt obligations which forces further liquidation because of falling income and prices (foreclosures and sheriff's sales).

Effects of Inflation and Deflation.—A rising price level results from increasing total expenditures and income. If all prices rose in the same proportion and if various kinds of income increased in a similar fashion, most of the disrupting effects of inflation would not appear. But this does not occur. Some money incomes rise slower (a few not at all) than the cost of living, and others faster. The former includes rentals (usually subject to long-term contracts), pensions, annuities, interest yields on bonds, and certain wages and salaries (for example, employees of state and local governments, schools and universities, hospitals, churches, and charitable institutions). Individuals depending mainly or entirely on such income, lose from inflation—their real incomes decrease. On the other hand, stockholders and other owners of business enterprises are likely to gain from inflation. As sales receipts increase from higher prices some costs tend to lag behind, and hence many profit incomes rise faster than the cost of living. Also, professional persons in independent practice and members of labor unions having great bargaining power usually experience a gain in real income.

Inflation not only alters the distribution of income, but also the distribution of wealth. Since rising prices mean decreasing purchasing power of money, many debt obligations contracted for a period of years involve a loss for creditors and a gain for debtors. For instance, a purchaser of a \$10,000 house obtains mortgage credit of \$8,000 to buy it. At the end of say five years only a few hundred dollars of the loan are repaid, the price level is doubled, and the owner sells the house for \$20,000. The creditor receives his loan of \$8,000, but its purchasing power is now only \$4,000—a loss of \$4,000. The debtor-owner receives \$12,000, or \$6,000 in current purchasing power—a gain of \$4,000 over his equity investment of \$2,000. Other kinds of creditor claims or assets fixed in terms of money, such as savings accounts, life insurance policies, and bonds decline in value because of inflation and the fall in the purchasing power of money. On the other hand, inflation increases the value of many kinds of ownership equities in buildings, land, unincorporated enterprises, and corporations (shares of stock).

Thus, because of inflation some groups in the economy lose in terms of income position and

creditor-debtor relations, and others gain. However, the kind of inflation is important in analyzing the overall effect. When rising prices reduce mass unemployment to a very small percentage and increase output substantially, the gains of inflation probably exceed greatly the losses. The increase in output moderates the rise in the price level, and hence the losses in real income and creditor status of some individuals. Perhaps a few individuals neither lose nor gain, but many are likely to gain—those having income increases greater than the price-level increase, debtors, and the mass of workers formerly unemployed. Also, the removal of serious unemployment lessens social and political tensions which may contribute to violence and general disregard of public law and order. In sum, this is a situation in which nearly everyone can be better off without making very many worse off.

The inflationary situation is quite different when the price level continues to rise after approximately full employment is attained and output no longer increases. Such pure inflation is likely to inflict severe hardships on many individuals whose money incomes are relatively fixed, and substantial losses on those having an important creditor status. Also, the relatively high prices discourage exports and encourage imports with a consequent loss of monetary reserves (mostly gold) in order to pay for the import excess. To cope with this adverse change in international economic relations, governments in modern times establish elaborate and costly foreign exchange controls. These controls, supported by heavy penalties, force exporters of a nation to exchange their receipts in a foreign money at a fixed rate for domestic money, and limit importers' purchases (kinds and amounts) so that there is no excess of imports over exports. When pure inflation reaches a hyperinflation stage, chaos ensues and total output decreases. Economic processes are disrupted and retarded because of speculative hoarding of raw materials and inventories, and the reversion to primitive barter for many transactions. Farm produce, for instance, is mostly exchanged, not for money, but for other goods. Many individuals barter their services and personal possessions in order to obtain food and other essentials. Many creditors are impoverished by receiving payment of loans in practically worthless money. Money income is spent as soon as possible after it is received in order to minimize loss of purchasing power because of rapidly rising prices. Hyperinflation usually ends by government action abolishing the old monetary unit and establishing a new one—existing currency and bank deposits becoming worthless, or being convertible in terms of the new money at a very low rate.

Suppressed inflation is usually less disadvantageous than open inflation particularly during a war emergency. However, even when it is a virtual necessity and is supported by war patriotism, there are adverse effects. The prices of many essential consumer goods are held down, but the distribution of ration coupons to limit purchases cannot avoid some inequities on the basis of individual and family needs. If at different times ration coupons are in excess of goods being made available, much time is lost in repeated shopping trips and waiting. Also, without frequent and costly rearrangement of maximum consumer prices, producers will shift output to more profitable items and neglect others so that

rationing control is in part defeated—some items are seldom available. Moreover, it is not feasible to control firmly the prices of many farm products, partly because production is discouraged. When some maximum consumer prices are raised, particularly those of foods, then ceilings on wage rates must be allowed to rise as compensation for the higher cost of living in order to maintain workers' energy and morale. But higher wage costs are likely to lessen the output of some consumer goods. Maximum prices can be set for raw materials and other producer goods, and priorities can be assigned to firms for their purchase (producer allocation or rationing), but these measures do not assure prompt delivery of the kinds and quantities of things to which firms are legally entitled. These maladjustments distort and hinder production. Illegal sales (black markets) of both producer and consumer goods flourish in spite of heavy penalties imposed on violators who are arrested. And lastly, when direct economic controls are extended beyond a war period to suppress inflation, the foregoing adverse effects are greatly magnified. In particular, the incentive to produce is weakened and patriotic appeals are ineffective. Although money wages are allowed to rise, price control and rationing force an increase in savings which soon becomes an unsatisfactory substitute for additional consumer goods even at higher prices. Workers unable to spend their wages for many things greatly desired develop a high rate of absenteeism on jobs, refuse overtime work at premium rates, and experience a deterioration in morale.

The effects of deflation may be stated briefly since they are mainly the opposite of inflation. During a decline in the price level, some prices and incomes decrease much less than others. Individuals depending mostly or entirely on rental income, pensions, annuities, interest yields on bonds, and certain wages and salaries gain from deflation—their real incomes increase. Stockholders, other owners of business enterprises, and professional persons in independent practice generally experience a decrease in real income from deflation. Concerning creditor-debtor relations fixed in terms of money, such as mortgages, savings accounts, life insurance policies, and bonds, deflation increases the purchasing power of creditor claims and imposes a burden on debtors to make repayments in money of greater purchasing power than that originally received. Also, deflation reduces the value of many kinds of ownership equities in buildings, land, unincorporated enterprises, and corporations.

In any deflation some groups in the economy lose in terms of income position and creditor-debtor relations, and others gain. The overall effect depends on changes in output and employment. For instance, a moderate decline in the price level which eliminates pure inflation without reducing an approximately full-employment output is likely to involve gains in excess of losses. A similar beneficial, overall effect appears when a mild deflation is the result of increasing productivity and is gradual enough to avoid more than a very small percentage of unemployment. But the deflationary situation is quite different when declining prices result in widespread business failures, extensive foreclosures of mortgaged farms, mass unemployment, and substantial reduction of total output—a

situation in which nearly everyone loses and only a very few gain. Because of bankruptcies and forced sale of mortgaged properties, some creditors as well as debtors lose. The losses incurred by mass unemployment (economic, social, and individual morale) cannot be measured, but they are so great that many modern governments try to prevent such a catastrophe. They use indirect economic controls—government expenditures and borrowing, and bank-credit measures—to offset any serious increase in unemployment. Also, they provide unemployment compensation and other aids to alleviate the hardships of those who become unemployed, and to maintain consumption expenditures.

Stabilization of the Price Level and Full Employment.—Many governments, particularly since World War II, try to stabilize the price level and at the same time to maintain a high level of employment. Certain control measures are used to offset deflation when employment declines appreciably below full employment, and to curb inflation once full employment exists. In the former instance government measures can be used to encourage business investment and consumer expenditures; namely, to have the central banking system (government owned or controlled) lower its interest rate on loans to commercial banks and provide other assistance so that they can make more credit available at lower interest rates to business enterprises and consumers. If such encouragement is insufficient to increase aggregate demand to a full employment level, then a direct increase in government expenditures and borrowing is used to raise aggregate demand. An increase in expenditures for public works and social services can be accompanied by a reduction in taxes, the deficit being financed primarily by the sale of government bonds to the central banking system. Aggregate demand for output is increased by the additional government expenditures, and the tax reductions free some private income for additional business investment and consumer expenditures. Such measures when applied firmly seem adequate to offset deflation and to restore approximately full employment. Popular support for a government program of lower interest rates, greater availability of credit, increased government expenditures and lower taxes is usually forthcoming.

To curb rising prices or inflation once full employment is attained, the above control measures are reversed. Interest rates are increased and credit is restricted in order to discourage business investment and consumer expenditures. Sometimes special regulation of consumer installment credit and mortgage credit for new houses is added. Government expenditures are reduced to curtail one segment of aggregate demand, and taxes are increased to reduce indirectly the other two segments, business investment and consumer expenditures. Effective tax curbs include increases in the rates imposed on business incomes, decreases in exemptions allowed for personal income taxation, and higher excise and sales taxes. The latter may tend in part to enter into the cost of living indexes, and thus automatically raise some wage rates covered by labor contracts providing cost-of-living increases. These measures can eliminate government borrowing and produce a budget surplus. Many difficulties, however, are encountered in applying such inflationary curbs and at the same time trying to maintain full employment.

One difficulty is the inexact nature of the statistics of employment and unemployment as already noted. This means that the size of the civilian labor force and its degree of utilization, partial or full employment are not precisely known at any time. Moreover, in using the available statistics it is recognized that some percentage of unemployment will probably persist although rising prices approach a stage of pure inflation. This circumstance arises because as aggregate demand increases and the amount of unemployed labor and unused production facilities shrinks to a very small percentage, shortages appear at some points in the production process and surpluses at others. The increase in aggregate demand is not spread evenly over the economy, and if it were, changes in production techniques alter labor and capital requirements in various industries. In some areas there is unemployment and unused plant capacity, but these unemployed workers cannot be quickly and easily transferred to areas having unfilled jobs, nor can unused plant capacity be quickly converted (if at all) to other kinds of output in great demand. If unemployed workers were able and willing to move quickly to unfilled job areas, their skills may not fit in many cases the job requirements, and hence retraining of old workers and training of new workers are necessary before certain kinds of outputs in great demand can be increased. The temporary failure of some outputs to increase, such as materials and equipment used by other industries, retards production and lessens employment in other parts of the economy. Such frictional unemployment, as it is called, is always present in the economy.

In general, then, as aggregate demand increases and unemployment falls to a small percentage, some outputs cease to expand appreciably, but their prices continue to rise; and other outputs continue to expand at slower rates, higher costs, and higher prices. Strong labor unions obtain wage increases in excess of productivity increases, and semimonopolistic firms raise prices to maintain or increase profit margins. Because of the tight labor market, other workers in industry, trade, and services obtain wage increases to offset the rising cost of living which are in excess of productivity increases. Primarily, rising costs push, and secondarily, rising incomes pull, prices upward. Soon a point is reached when increasing aggregate demand results in major price increases and only in minor output increases, but frictional unemployment still persists and is likely to persist until pure inflation occurs. Thus, another difficulty of curbing inflation and maintaining "full employment" is the determination of the critical point at which the losses of many individuals from price-level increases are greater than the limited gains in output and employment, and at which the wage-profit-price spiral suddenly explodes into pure inflation.

Presumably some latitude should be permitted in the stabilization of the price level and in the maintenance of full employment. However, policy concerning the range of permitted fluctuations is a matter of controversy. Since the exact amount of irreducible, frictional unemployment cannot be calculated, there is disagreement as to whether inflationary curbs should be applied to rising prices when unemployment is (say) 5, 3, or 1 per cent of the civilian labor force. One suggestion is that such curbs be applied lightly, if at all,

to rising prices when some unemployment exists, as long as the percentage increases in total output are in excess of the percentage increases in the price level. Clearly, if inflationary curbs are imposed too early (say at unemployment of 5 per cent) and too drastically, deflation and widespread unemployment may quickly develop. On the other hand, if such curbs are imposed too late (say at unemployment of 2 per cent) and too mildly, pure inflation may quickly develop. Because of these uncertainties, difficulties, and other pressures, governments now attempt mostly to hold inflation on the average to a creeping rate. This policy encourages a high level of employment as the labor force grows in size, stimulates investment, brings some increase in total output, and lessens the burden of government debt. Apparently, it wins popular support. A program for halting creeping inflation involves higher interest rates, credit restriction, reduction of government expenditures, and higher taxes, and is not likely to generate political support. Small firms, for instance, are generally more dependent than large ones on the use of bank credit, and they object to higher interest rates and restriction of credit. Restriction of consumer installment credit and mortgage credit for new houses is opposed by many consumers and by the suppliers of consumer durable goods and houses. A reduction of government expenditures may be generally approved, but there is bitter conflict concerning specific cuts in expenditures particularly when they affect certain areas of, or groups in, the economy more than others. And lastly, increases in taxes are seldom popular, and sharp controversy develops concerning the kinds and amounts of tax increases—whose taxes are to be increased and how much.

Thus, some creeping inflation and maintenance of a very high level of employment seem to be preferred, or tolerated, as compared with approximate stabilization of the price level at a somewhat lower level of average employment. In time a satisfactory compromise between these alternatives may be achieved. Special government programs may be developed to reduce frictional unemployment to a very moderate percentage, and unemployment compensation may be increased to eliminate the hardships of such unemployment, and any other unemployment created temporarily by inflationary curbs to achieve approximate stabilization of the price level. Perhaps selective controls of interest rates and the availability of credit may be arranged so that any restriction will affect more equitably firms of various sizes, different groups of consumers, and certain kinds of essential public investment (for example, schools) as compared with many kinds of private investment. However, since World War II nearly all governments appear to follow a common policy; namely, that adequate inflationary curbs can halt increases in the price level only by depressing substantially the level of employment and output, and that existing measures to offset and alleviate the effects of this deflation are insufficient to make such a program politically feasible. The history, therefore, of price trends in most nations in recent years is one of varying degrees of inflation.

Price Trends in the United States.—For more than a decade before World War I prices were slowly rising in the United States, but the open inflation of the war period radically changed this trend. The index of wholesale

prices more than doubled from 1914 to its postwar peak in 1920, and the consumer price index (cost of living) also doubled. During the same period the average weekly earnings of workers in manufacturing industries increased somewhat more than the cost of living. In 1920 a deflation began which lowered wholesale prices in an irregular fashion to a record low in 1932—slightly below the level in 1914. Prices of farm products declined more than those of industrial products. However, the decline in retail prices reflecting the cost of living was substantially less than wholesale prices, and at the low point in 1933 the consumer price index was almost 30 per cent above the 1914 level. During this period (1920–1933) the average weekly earnings of workers in manufacturing industries declined slightly more than the cost of living, but at their low point in 1933 were about 50 per cent higher than in 1914. This represented a gain in real wages for those employed, but in 1933 approximately 25 per cent of the civilian labor force was unemployed—a record low as compared with 1920 and 1914.

After the great deflation or depression in 1932–1933, wholesale and consumer prices in the United States rose generally, including the suppressed inflation of World War II, with only a few brief and slight declines in 1938–1940, 1949, and 1952–mid-year 1956. During the latter period wholesale and consumer prices remained relatively stable—the decline in the prices of farm products and processed foods more than offset the price rise for some industrial products in the wholesale index, and the decline in consumer-commodity prices approximately offset the rise in consumer services and rent. However, in January 1957 the wholesale price index reached a record high—about 133 per cent above the pre-World War II level of 1939, and almost 17 per cent above the previous peak of 1920. Between 1939 and January 1957, prices of farm products increased (with a few temporary declines) somewhat more than those of industrial products. The consumer price index (cost of living) also reached a record high in January 1957—about 99 per cent above the pre-World War II level of 1939, and 38 per cent above the previous peak of 1920. The average weekly earnings of workers in manufacturing industries in January 1957 were 245 per cent above the pre-World War II level of 1939; industrial production, about 152 per cent above the 1939 level. In January 1957 only 4.5 per cent of a much larger civilian labor force was unemployed as compared with approximately 17 per cent in 1939.

Thus, in the United States the second great inflation of the 20th century. World War II and its aftermath, approximately doubled the price level. The purchasing power of the dollar at the beginning of 1957, as compared with 1939, was slightly less than one half in terms of the wholesale price index and only fractionally more than one half in terms of the consumer price index. However, during this period, total output, income, and population increased greatly. When allowances are made for the increase in prices, total output (gross national product) was 110 per cent greater at the end of the period than in 1939, and about 70 per cent greater on a per capita basis; and total disposable personal income (personal income less personal taxes) was 108 per cent greater or about 62 per cent on a per capita basis. This means that a substantial in-

crease in real income occurred—the increase in goods and services and in money incomes more than offset the rise in prices. The purchasing power of the dollar declined approximately 50 per cent, but the spending power of consumers per capita increased 62 per cent. Since the amount of unemployment in January 1957 was much less than in 1939, and since disposable personal income was more equally distributed, the increase in real disposable personal income per capita reflected a substantial improvement in living conditions for most individuals and families. Of course, the gains and losses experienced by different groups during the process of inflation (1939–January 1957) are not revealed in the above comparisons. Moreover, there is uncertainty concerning future price trends. In order to curb rising prices in 1956–1957, interest rates were raised to the highest level since 1933 and some effort was made to prevent an increase in federal government expenditures.

Price Trends in Canada.—Inflation in Canada since 1939 followed a pattern similar to that of the United States. After World War II price and wage controls were terminated in 1947, about one year later than in the United States. Between 1939 and early 1957 the level of wholesale prices more than doubled, an increase of 131 per cent as compared with 133 per cent in the United States. The index of consumer prices (cost of living) almost doubled, but showed an appreciably smaller percentage increase (90 per cent) than that of the United States (99 per cent). Average weekly earnings of workers in manufacturing industries increased about 196 per cent, and at the end of 1956 only 3 per cent of the labor force was unemployed as compared with an estimate of 12 per cent for 1939. During the period total output, income, and population increased. When allowances are made for the increase in prices, total output (gross national product) was 141 per cent greater in 1956 than in 1939, and about 70 per cent greater on a per capita basis; and total disposable personal income was 150 per cent greater or about 76 per cent on a per capita basis. This represented a substantial increase in real income for consumers—76 as compared with 62 per cent in the United States. However, the appreciable rise in prices in 1955 and 1956 induced the government to raise interest rates and restrict credit in an attempt to halt inflation.

Price Trends in the United Kingdom.—Inflation in the United Kingdom since 1939 followed a somewhat different pattern from that of the United States and Canada. Price controls were not terminated until 1953, and some rationing of food was continued until the middle of 1954 which marked the end of 14 years of rationing. Between 1939 and early 1957 the level of wholesale prices more than doubled, which involved a percentage increase slightly greater than that of the United States and Canada. During the same period the index of consumer prices (cost of living) almost doubled, but showed an appreciably smaller percentage increase than that of the United States, and approximately the same increase as in Canada. Government subsidies, however, for housing, bread, and milk held the rising cost of living partly in abeyance. Average earnings per hour in manufacturing industries increased more than 230 per cent. At the end of 1956 about 1 per cent of the labor force was unemployed, and a

larger total output and money income provided a moderate increase in real income. Because of the appreciable rise in prices in 1955 and 1956, the government increased substantially the bank rate of interest, imposed selective credit restrictions on installment buying, levied higher taxes on the purchase of consumer durable goods, and reduced some government expenditures. In September 1957 the bank rate of interest, increased from 5 to 7 per cent, was at the highest level it had reached in the United Kingdom since 1920.

Price Trends in France.—Inflation in France since 1939 approached a stage of hyperinflation. Although some price, wage, and credit controls were used in the postwar period, they could not overcome the great disruption of economic processes which occurred during the war and enemy occupation of the country. Government borrowing, mainly from banks, was used to meet expenditures in the postwar period. Between 1939 and early 1957 the level of wholesale and consumer prices (cost of living in the Paris region only) increased more than 2,000 per cent, or 20-fold. Some government subsidies continued to depress arbitrarily the cost of living. Average rates of pay per hour in manufacturing industries increased almost 2,500 per cent. At the end of 1956 probably less than 1 per cent of the labor force was unemployed, and total output was larger than in 1939. However, the increase in real income of consumers was very moderate. In 1956, after three years of relative price stability, further price increases induced the government to impose additional restrictions on credit, raise some taxes with the hope of lessening the budget deficit, and to freeze industrial prices. The government in 1957 intensified efforts to suppress the upward adjustment of some prices and wages. It also adopted the equivalent of a 20 per cent devaluation of the franc. In sum, a situation of suppressed inflation continued. See also GOLD STANDARD, THE; PRICES.

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INFLECTION, ĭn-flek'shŭn, a grammatical term used in describing the different forms by which a word may indicate such systematic variations of meaning and function as those of case, person, number, and tense. (See GRAMMAR.) For example, Latin *amo* "I love," *amas* "you love," *amat* "he loves"; English *love*, *loved*, *loving*. The word *inflection* is an inheritance from the Roman grammarians (for example, Donatus: *pronomina inflectuntur hoc modo* "pronouns are inflected in this way"), for whom in turn it was a translation from the grammatical terminology of the Greeks. The Greek grammarians thought of one form—the nominative in nouns and the present in verbs—as being "normal" or "unmodified" and of the others as "turning away" or "bending down" from it. Therefore the Romans used the word *inflectare*, "to bend down." Similarly, the word *casus*, our word *case*, meant "the

act of falling"; the Romans distinguished *casus rectus*, the "upright" case, from *casus obliquus*, the "inclined" case, hence our term oblique case, meaning any case other than the nominative.

Not all languages have inflection. Even those that are genetically related may differ considerably, for the amount of inflection may change during the history of a language. Among the Indo-European languages, English has two forms for the singular of the noun, nominative *boy* and genitive *boy's*; Latin has five; Sanskrit, eight. The declension of the adjective is a striking example of loss of inflection in English. Modern English has only the one form *good*, but the Old English of a thousand years ago had nominative *god*, genitive *godes*, dative *godum*, accusative *godne*, and instrumental *gode*. On the other hand the case system of Hungarian seems to be expanding through the specialization of a number of postposed suffixes, which are already classed as case endings by some authorities. Furthermore, for many languages the whole idea of inflection is irrelevant, since they have completely different methods for indicating variations in meaning and function (see *LANGUAGES OF THE WORLD—Methods of Classification*).

The particular role of inflection varies considerably from language to language, but in general the inflection of a word helps to show to what part of the morphological system it belongs. In many languages, as in English, it is possible to make changes in meaning or function systematically by changing the form of the word rather than by using an additional explanatory remark or a different word altogether. Here again some languages have more elaborate morphological systems than others. To express number, English has two systematic possibilities—singular *bird* and plural *birds*, and many that are nonsystematic: *two birds*, *many birds*, *few birds*, *a flock*, and so on. In classical Greek this section of the morphological system was fuller by one degree: *ornis* "bird" and *ornithes* "birds," but also *ornithe* "two birds."

As inflection disappears from a language, other devices assume its function. Characteristic is the English use of word order. In the sentence *The boy gave the dog a bone*, the nouns do not differ in inflection, yet the function of each is made clear by its position in the sentence. *Boy*, which would have the special ending of the nominative case if the sentence were written in Latin, is shown to be the subject by being placed before the verb; *dog*, dative in Latin, is the indirect object, placed first after the verb; and *bone*, accusative in Latin, is the direct object, being the second noun after the verb. Any interchange in the position of these words would give either a different meaning or nonsense.

Some scholars have speculated on the problem of just what amount of inflection makes a language the best vehicle of communication, but except for an understandable tendency for each to rate his own type of language highest, there has been no considerable agreement.

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INFLORESCENCE, INFRUCTESCENCE, botanical terms referring respectively to methods of flowering and fruit bearing. The flowering shoot frequently bears only a solitary, either axillary or terminal flower. In many

cases, however, the metamorphosis of the generative region, which results in the production of flowers, has led to the formation of a special system of fertile shoots termed an inflorescence or, after the fruit is formed, an infructescence. (See *FLOWERS*; *FRUIT*.) Such inflorescences are wanting or ill developed among the gymnosperms, while in the angiosperms they are often well differentiated, constituting unities of a higher order. The modifications exhibited by the fertile shoots of such an inflorescence are due, partly to a difference in their mode of branching, partly to the reduction of the metamorphosis of their leaves. These changes are the result of an adaptation to pollination, in the endeavor to aggregate and at the same time render the flowers more conspicuous by the reduction of the foliage leaves. Sometimes the whole system of fertile shoots is converted into an attractive apparatus, as in the *Araceae*, where the axis and the subtending leaf of the inflorescence have assumed the function, usually exercised by the perianth, of enticing insects.

The solitary flower excepted, the principal types of inflorescence are called *racemose*, *cymose*, and *mixed*. Representative of the racemose are the lily of the valley (raceme) and the cherry (corymb); of the cymose, the phlox (cyme); and of mixed type, the form called thyrsus in which the main axis is racemose, while secondary and later axes are cymose. Another mixed type is the verticillaster in which nearly sessile cymes in pairs surround the axis.

INFLUENZA, in-flō-ēn'zā, an acute infectious respiratory disease caused by a specific group of viruses. It is highly transmissible spreading with extraordinary rapidity in sporadic, epidemic, or pandemic outbreaks. The disease is characterized by sudden chills, fever, headache, muscular pains, and prostration. The name "influenza" (Ital. influence) reflects the fact that it was once thought to be due to the influence of the stars upon man. The popular terms "flu" and "grippe" should likewise be restricted to this disease, and not applied to common respiratory diseases with systemic manifestations.

The first recorded epidemic of influenza occurred in Italy, Germany, and England in 1173. This was a mild infectious invasion, but the first pandemic in 1580 resulted in the death of thousands daily. The term "influenza" first came into common English usage during the European epidemic of 1743, which was followed by 24 pandemics in all continents, increasing in frequency and severity until the 1918 pandemic, which cost 30 million lives. The gradual decline in incidence and severity of the disease is manifested by progressively shorter peaks of invasiveness and lower troughs of mortality. A marked rise in the influenza mortality of the older age group from 25 per cent in 1918 to 88 per cent in 1951 is attributable to underlying chronic degenerative diseases.

Types and Diagnosis.—The riddle of the causation of influenza was solved by the British bacteriologist Wilson Smith in 1932 with the demonstration of influenza A virus in throat washings of afflicted patients, who revealed specific antibodies during convalescence. Later, the American, Thomas Francis, isolated the influenza B virus and its antibodies in patients during the 1940 epidemic; Richard Moreland Taylor, the influenza C virus in the 1949 epidemic; and A.

Sendai, the influenza D virus in the 1953 epidemic in Japan. The alphabet designation merely represents the order in which the viruses were discovered. They are all about 100 millimicrons in diameter, visible as a sphere or filament by the electron microscope, and showing marked affinity for the respiratory epithelium of mammals. Infection with one type of virus confers no immunity against any of the others, and that produced is temporary in contrast with other viruses such as measles, smallpox, and yellow fever, whose attack leads to a permanent change in the attitude of the host.

Influenza A epidemics start abruptly, reach a peak in two weeks, and subside rapidly after attacking about 40 per cent of the urban population, appearing simultaneously in widely separated areas as minor respiratory infections. The virus becomes widely seeded in avirulent form during the summer months and remains dormant until cold weather precipitates outbreaks at many foci, its virulence increasing with the rapid spread of the infection in susceptible individuals. Influenza A virus causes major winter epidemics, which recur at two- to four-year intervals as a result of the decline in the effective immunity of a population and the emergence of new virus strains. The influenza that prevailed between 1933 and 1945 completely disappeared but was replaced by four new serologically intersecting groups designated as influenza A', with marked changes in antigenicity, isolated in epidemics in South Africa and Australia (1950), England (1951), and Europe, Japan, and the United States (1952). Striking changes in the strains of influenza A' virus were subsequently detected in China in 1957, in the virus responsible for the Asian pandemic.

Influenza B and C occur sporadically in schools and camps, the former at four- to six-year intervals and the latter at any time. Influenza A causes typical pandemics, influenza B, moderate epidemics; and influenza C, mild outbreaks.

The diagnosis of influenza is easy during epidemics but difficult during endemic attacks. Each of the four viruses produces a clinical picture ranging from mild infection to severe prostration complicated by pneumonia. Influenza A is accompanied by a more definite pattern of symptomatology than influenza B, but there are no means of clinical differentiation without laboratory studies. The causative influenzal virus can be isolated within five days by inoculation of the acute nose and throat secretion into a chick embryo, and later by the demonstration of a significant rise in serum antibody titers produced by known influenza virus antigens during the convalescent stages.

Spread and Course of Disease.—The origin of an epidemic depends on the appearance of a new strain of virus arising locally or introduced from without, and with sufficient capacity to spread. Attack rates of influenza vary from 1 per cent to 20 per cent, being lowest in sparsely settled communities and highest in congested areas. The virus is maintained by sporadic cases during intervals between epidemics. Droplets from an infected nose and mouth reach susceptible individuals via the respiratory tract. Attacks are usually mild because most individuals over five years of age have antibodies against influenzal viruses, although specific immunity after an attack lasts only about eight months because of the localization of the infection to the respiratory mucous membrane. Specific immunization is pro-

portional to the level of the serum antibody titer, but influenza may attack individuals with high antibody levels.

The incubation period of influenza is generally 18 to 36 hours but may be as long as 72 hours. Mild prodromal manifestations of malaise, chilliness, and cough may appear, but the extremely sudden onset enables one to recall its exact time. The frontal headache is accentuated by upward gaze, and diffuse aches in the back and legs limit movement. There may be faintness and dizziness from the onset followed by feverishness and chilliness. The fever rises abruptly to about 103° F. several hours after the onset and occasionally to 106° F. Both fever and pain generally subside after two or three days but may persist for weeks, with a secondary rise of fever after subsidence.

The severity of influenza parallels the height and duration of the fever. Respiratory manifestations develop when the fever subsides, or they may be entirely absent. Such manifestations include sneezing, nasal discharge, blocked breathing, dryness of the throat, hoarseness, and nosebleeds. Some cases reveal itchy, watery eyes, stuffed nose, and sore throat; others, productive coughs with thick mucoid sputum and chest pain, aggravated by coughing. Prostration is alarming, with face flushed, skin hot, extremities mottled, and sweating profuse. There is usually a loss of appetite, nausea, abdominal pain, and constipation, but rarely vomiting and diarrhea. "Intestinal flu" is a misnomer because the influenzal virus does not enter the gastrointestinal tract.

Complications of influenza include secondary bacterial infections of the nasal sinuses, middle ear, bronchi, and lungs. There is a marked rise in the incidence of bacterial pneumonia during influenzal epidemics, especially staphylococcal pneumonia, which runs a fulminant, often fatal course. Recovery from uncomplicated influenza is complete within two to three days or possibly a week, but convalescence is complicated by fatigue, asthenia, and depression, especially in the elderly, who show minor relapses with mild fever.

Prevention and Therapy.—A formalized egg vaccine of the A and B viruses protects 70 per cent of the vaccinated, provided a strain closely related to the strains responsible for the epidemic is present in the vaccine. The vaccine is injected in a single 1-cubic centimeter (cc.) dose subcutaneously to adults; in two 0.5-cc. doses (two to four weeks apart) subcutaneously to older children; and in two intradermal 0.1-cc. doses (two weeks apart) to young children, if there is no allergic sensitivity to eggs or egg products. The reaction rate is about 5 per cent in adults, 20 per cent in older children, and very high and hence dangerous in young children. In 1944 in the United States, 7.1 per cent of the unvaccinated developed influenza in comparison with 2.2 per cent of the vaccinated, while the efficacy of the 1958 vaccine, containing the A' virus attenuates, was about 70 per cent.

Immunization lasts from six months to a year; hence the need for revaccination each fall with a vaccine containing the new antigenic variant of the virus. Influenzal prophylaxis reduces the incidence of infection during epidemics in closed population groups such as schools and camps, but not in the population as a whole. There are several limitations: an attack may occur in spite of the high levels of serum antibody; vaccines are prepared from viruses that differ antigenically from the most recent strains; antibody concen-

tration is low at the site of infection in the respiratory tract; and the protective effect lasts but several months. Public health workers remain on the alert for an impending epidemic, planning preventive and emergency services through a network of World Health Organization reference laboratories.

Specific therapy is neither available nor necessary, for influenza is usually self-limited. Aspirin or APC tablets (aspirin, phenacetin, and caffeine) are offered every four hours. Fluid intake is encouraged to compensate for electrolytes lost in excessive perspiration. A soft diet is offered according to taste. Antibiotics neither affect the course of uncomplicated influenza nor prevent complications. Bed rest is necessary during the febrile course of the illness, but bathroom privileges are permissible. Activity is encouraged after the temperature returns to normal, but fatigue should be avoided. Asthenia during convalescence requires more gradual ambulation until full recovery is attained. There is no evidence that vitamins, iron, tonics, and other body-building remedies are of any value in accelerating recovery.

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INFORMATION, in-för-mă'shūn, a proceeding for some offense, usually against the government, differing from an indictment in not being found by a grand jury. It is usually brought by an authorized public official and is in use in the United States and Great Britain. The use of information in the United States is restricted to misdemeanors in criminal cases, but it is allowed in certain civil cases, as to bring a person who has assumed the duties of a civil office into court to show by what authority he so acts or to arraign a corporation for failing to observe the provision of its charter. In England information in criminal cases is brought by the attorney general or solicitor general, but not for treason, misprision of treason, or felonies; however, it is rarely used there except for aggravated offenses, such as sedition, or crimes that are pernicious, such as attempting to bribe public officials. In the United States, in some jurisdictions, violations or attempted violations of the revenue laws are proceeded upon by information. The term is also applied to the written sworn statement made, as before a committing magistrate, prior to the issuance of a summons or complaint. See also INDICTMENT.

INFORMER, in-fôr'mēr, a person who sues for a penalty against those who have infringed any law or penal statute. To encourage the apprehending of certain felons, guilty of offenses not so much criminal as bordering on criminality, many English statutes, from 1692 onward, granted rewards to such as should prosecute to conviction. The fine or penalty in whole or in part inflicted

in the case of a successful conviction and immunity from certain troublesome parish offices were the inducement extended to informers. In many cases resort to this practice has been made in modern statutes. But the institution of a crown prosecutor in Great Britain and of prosecuting attorneys in the United States has nullified the importance of informers to a great extent. One who provides evidence or sues solely to obtain a share of the money penalty assessed is known as a common informer.

INFRARED RADIATION, in-frā-réd' rā-dī-ā'shūn, in physics and optics, that portion of the electromagnetic spectrum which extends from the limit of deep red visible light at about 7,800 angstroms to the microwave region of radio waves at about 1,500,000 angstroms in wavelength. (An angstrom is a unit of length equal to approximately one two-hundred-fifty-millionth of an inch.) Such waves vibrate from 400 trillion times a second (near the visible red portion of the spectrum) to 800 billion times a second (near the microwave end).

Infrared radiation is another name for radiant heat—heat that radiates from a source such as the sun, an electric light bulb, or a candle flame. It is not necessary that the source emit visible light. An electric iron, for example, does not become even red-hot, yet it is a producer of abundant infrared. In fact, any object, such as an ordinary home radiator (steam or hot water), which is warmer than the air around it, radiates heat energy or infrared radiation.

In the electromagnetic or radiant energy spectrum, which includes radio waves, visible light waves, ultraviolet, X-rays and others, the infrared region occurs adjacent to the red end of the light spectrum, which we see as a rainbow of colors, and extends to the region of very short radio waves (microwaves). Hence the prefix *infra*, meaning "below" the red. It is, in effect, "light" having wavelengths too long for our eyes to see. Our sense of touch, however, captures these wavelengths for us and our brain interprets and tells us that "this is hot."

Almost all the practical and common uses of infrared energy utilize the shorter wavelengths from 7,800 to about 40,000 or 50,000 angstroms. This band of waves is called "near" infrared. Uses for "far" infrared radiation between 50,000 and 1,500,000 angstroms are considerably more limited, although these waves exhibit characteristics which provide an intriguing field for further exploration and research in medicine.

Sources and Control of Infrared.—Near infrared energy for commercial and industrial use usually is produced by incandescent lamps so designed that some of their visible light output is sacrificed so that infrared radiation may be produced with greater efficiency. Another efficient method utilizes gas-fired infrared units called "gas radiants." Like other wavelengths of electromagnetic radiation, infrared waves travel through space at the 186,000-mile-per-second speed until they strike a surface where they are absorbed. Most nonreflective substances will absorb and convert into heat a large percentage of the radiant infrared energy striking them, whereas reflecting surfaces redirect and control it, just as visible light waves are reflected and controlled.

Industrial Applications.—Aside from providing heat to make us comfortable, infrared is put to work in many industrial processes. These

include paint and enamel drying, baking, pre-heating, and dehydrating.

Basically these processes are the same. Banks of incandescent infrared lamps are used, each lamp being equipped with its own reflector. The reflector can be applied as an "aluminized" surface to the glass bulb itself or as a separate element in back of a lamp. Gold-plated steel reflectors, while not as efficient as other surfaces for visible light, reflect the greatest amounts of useful infrared and are used extensively in industry. Such reflectors control the infrared rays, just as do those used for visible light. An opaque object placed in the "beam" of radiant heat will cast an invisible "shadow" by absorbing the radiations that strike it.

The one pronounced advantage of using radiant infrared energy for drying paints, lacquers, and similar finishes or for dehydrating and baking materials is the reduction of time involved to accomplish the task. Near infrared radiation is penetrating, that is, the heat is absorbed *within* the object being treated, so that a film of paint tends to dry from the inside out rather than from the surface inward, as with oven drying or baking. Processes that formerly required as much as 15 to 20 hours normal drying time are frequently completed with infrared in a matter of 15 or 20 minutes. Others may require no more than one or two minutes, as compared with over an hour for oven drying.

Different materials, such as iron and wood, have different heat-conducting characteristics, and the types of finishes to be dried or baked vary widely in their composition, so that more time will be required for some than for others. The color of a finish also affects its drying time. Light finishes usually take longer to dry thoroughly, because some of the infrared will be reflected, whereas darker paints or lacquers dry more rapidly by virtue of more rapid infrared absorption. The same time differences occur in dehydrating operations. A hard, wet surface of metal can be dried more quickly, for example, than a wet rug or a water-soaked piece of wood, but in either case the drying time would be less than with heated air as the only drying medium.

Radiant heat requires no air for its transmission. The air present between an infrared source and the object is heated only to a comparatively negligible extent. Thus with infrared radiant drying it is not always necessary to exclude circulation of air or to provide insulation to confine the heat. Some ovens are enclosed, however, in order to heat the air and, therefore, to aid the drying action, while others may be left open to allow the escape of fumes and smoke resulting from paint drying.

Infrared Therapy.—Infrared radiation also serves in the field of medicine. The sun, producing more than an abundance of infrared, has been considered and recognized as a great healing agency since the dawn of civilization. The same radiations as those of the sun, produced artificially in therapeutic lamps, have the characteristic warming effect, so that heat is generated in the body tissue directly beneath the skin and is transmitted deeper by conduction. Bruised and strained muscles and ligaments can be relaxed and soothed with a consequent decrease in pain by infrared application.

Infrared Photography.—The use of infrared radiation in photography has made it possible to extend that art beyond the limits of normal

vision. Objects can be photographed in absolute darkness or through a haze which makes them visually obscure.

We see an object by virtue of the visible light which it reflects. Most objects reflect infrared as well as light, but infrared is beyond the limit of the eye's sensitivity. A camera, however, equipped with film sensitized to infrared radiation by means of special emulsions will capture objects or landscapes which the eye cannot see. Thus, an object in the kitchen can be photographed at night and without light, merely by heat from a stove which is not even red-hot. Since infrared possesses far greater penetrating power than visible light and since all objects reflect infrared, it is possible to photograph landscapes through a haze so thick that they cannot be seen. After considerable research work, film which is sensitive to infrared radiation as long as 12,000 angstroms in wavelength has been developed. If this film is used in the daytime, special lens filters, which are opaque to visible light but not to infrared, must be placed over the lens. Black and white photographic prints from an infrared film have a somewhat unusual reversed appearance due to reflection factors of objects which are different for infrared than for visible light. A blue sky or lake, for instance, will appear quite dark, whereas red, green, or yellow objects will appear much lighter than in a regular photograph.

Conversion of Infrared to Visible Light.—Since infrared radiation is invisible, but behaves much like visible light, that is, can be reflected and controlled in a beam pattern, it has served as a means of communication for specific wartime applications. Signaling in code with infrared radiators was accomplished during World War II, and the development of equipment which would receive the invisible signals and convert them into visible light was the foundation for the design and successful use of some highly important weapons.

An infrared rifle, sometimes referred to as the "sniperscope," was used most effectively. It is equipped with an infrared source and reflector which focuses a rather concentrated invisible beam for some distance in the direction of aim. In this way, an area in the line of sight is "spotted" with invisible radiation and reflects this radiation toward the rifleman. The reflected energy from the target is received and converted electronically into a visible scene that only the rifleman can see.

The conversion of infrared energy into visible-light energy is comparatively simple in the signaling operations, since it is only necessary to perceive a "flash" or impulse. This is accomplished, basically, with an infrared sensitive cell or phosphor button which is excited by the invisible signal and reradiates it as a visible flash of light at the receiving end.

Infrared Cooking.—Although all food cooking utilizes infrared at the source of heat, those appliances which use it directly rather than through pots, pans, and other utensils, are rather often referred to as "infrared cookers." These are such appliances as broilers and toasters, wherein the food is exposed directly to the infrared radiation.

Discovery and History.—The existence of the infrared region was discovered by Sir William Herschel, an English astronomer of German origin, who was the first to think that heat was

distributed unequally in the solar spectrum. Using a prism, he found, in 1880, that a thermometer placed beyond the red end of the spectrum recorded a higher temperature than one in the areas of visible light. James Clerk Maxwell, the Scottish physicist, formulated the electromagnetic theory of light in a series of papers published in 1864 and 1873, and suggested that there might be other waves longer even than the infrared. An American, Samuel P. Langley, who carried on important investigations in this area, invented the bolometer (q.v.) in 1878 to obtain more precise measurements. The English chemist and physicist, Sir William Abney, was apparently the first to make use of infrared in photography about 1880. In 1901, the German physicist, Max Planck, introduced his theory that energy transfers in radiation occur in distinct increments of energy called "quanta," and this has led to the development of modern quantum mechanics. See also HEAT TRANSFER; LIGHT; QUANTUM THEORY; SPECTROSCOPY.

DON P. CAVERLY,

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INFRINGEMENT, in-frinj'měnt, in law, means the wrongful invasion of some legal right. The term has no technical meaning except when associated with other words, as, for example, in the phrase "infringement of a patent." Thus the word *infringement* may be applied to the breach of a contract, the violation of a corporation's right to the exclusive use of its name, or the invasion of a ferry franchise by a competing ferry or bridge. Ordinarily, however, infringement refers specifically to patents, copyrights, trademarks, or trade names, and the term has various technical definitions depending upon the particular phrase in which it is used.

Infringement of a patent is the unauthorized making, selling, or using a device which accomplishes substantially the same result as a patented object by substantially identical means and method of operation. The unauthorized manufacture, sale, or use must take place within the area and the time covered by the patent. A close copy constitutes an infringement, even though there are changes in form or position of the operative parts of an apparatus. Infringement cannot be avoided by a multiplication of the elements and parts of a patented invention or by a separation of one integral part into two. Merely obtaining the same result is not an infringement, if substantially the same means and methods are not used. In the case of a design patent, the test of infringement is substantial similarity which might deceive the ordinary purchaser.

Infringement of a trademark or trade name consists of the unauthorized use of a closely similar, but not necessarily identical, mark or name. As in the case of a patent design, the test is whether an average purchaser buying with ordinary care would probably be deceived by the similarity of the mark or name.

Infringement of a copyright is the copying of a substantial portion of copyrighted material. As in the case of patents, the term applies only to acts done within the territorial and temporal limits of the copyright. Material which may be the subject of copyright infringement includes literary works, musical compositions, works of art, maps and charts, photographs, and motion pictures. See also PATENTS, THE LAW OF; TRADE-MARKS.

RICHARD L. HIRSHBERG.

INFUSORIA, in-fû-sô'ri-à, a group of microscopic organisms, especially Protozoa. Originating about 1760, the term has had various meanings since that time, but dropped from use in the 1930's. Originally it included all the microscopic organisms which appear in infusions of dead animal or vegetable materials. Later it was restricted to those organisms which are now placed in the phylum Protozoa; still later, to those protozoans now in the class Ciliata.

INFUSORIAL EARTH, in-fû-sô'ri-ăl ūrth, is earth composed of or containing the remains of infusorians; the term is often incorrectly applied to diatomaceous earth.

INGALLS, ing'gälz, **James Monroe**, American soldier: b. Sutton, Vt., Jan. 25, 1837; d. Stamford, Conn., May 1, 1927. He served in the Civil War as an enlisted soldier and remained in the South until 1871 during reconstruction. In 1882 he founded the Department of Ballistics at the United States Artillery School, Fort Monroe, Va., and was the principal instructor there until the school suspended operations in April 1898, on the outbreak of the war with Spain. He wrote extensively in the field of ballistics, among his works being the volumes *Ballistic Machines* (1885); *Exterior Ballistics* (1883; 2d ed., 1886); *Ballistics for the Instruction of Artillery Gunners* (1893); *Ballistic Tables* (1891; rev. ed., 1917); and *Interior Ballistics* (1894; 3d ed., 1912).

INGALLS, John James, American politician: b. Middleton, Mass., Dec. 29, 1833; d. Las Vegas, N.Mex., Aug. 16, 1900. After graduating from Williams College in 1855, he was admitted to the Massachusetts bar in 1857 and in 1858 moved to Kansas, where he established a law practice first in Sumner and then, in 1860, in Atchison. Ingalls was a delegate to the first constitutional convention, the Wyandotte Convention, in Kansas in 1859, and served as secretary of the territorial council (1860) and of the state Senate (1861). He was elected a member of the state Senate in 1862. He acted as judge advocate of the Kansas militia during the Civil War and later edited the *Atchison Freedom's Champion*.

In January 1873 the Kansas legislature sent Ingalls to Washington, D.C., as senator, an office to which he was subsequently re-elected in 1878 and 1884. Charges that bribery had been practiced in connection with his election in 1878 were made in and investigated by both the Kansas House of Representatives and the United States Senate, but Senator Ingalls was exonerated and he retained his Senate seat. From 1887 to 1891 he was president pro tempore of the Senate. During his terms in the Senate he became well known for his oratory, especially for his vitriolic attack and abuse; he constantly waved the "bloody shirt" and appealed to sectional hatreds. Again a Republican candidate for the Senate in 1890, Ingalls was defeated by the Populist Party candidate. His writings were edited by William E. Connelley as *A Collection of the Writings of John James Ingalls* (Kansas City 1902).

INGALLS, Melville Ezra, American railroad executive: b. Harrison, Me., Sept. 6, 1842; d. Hot Springs, Va., July 11, 1914. He studied at Bowdoin College and was graduated from the Harvard Law School in 1863. Subsequently he practiced law successively at Gray, Me., and Bos-

ton, Mass. He specialized in corporation law, particularly as it affects transportation, and in 1870 became president of the Indianapolis, Cincinnati & Lafayette Railroad. By 1880 he had twice reorganized the company, consolidating it with another line to form the Cincinnati, Indianapolis, St. Louis & Chicago Railway, of which he was named president. Finally, in 1889 he consolidated his line with the Bee Line of the Vanderbilt interests, forming the Cleveland, Cincinnati, Chicago & St. Louis Railway Company, which he served as president until 1905. Ingalls was also president of the Kentucky Central Railroad (1881–1883) and the Chesapeake & Ohio Railway Company (1888–1900). Vigorous, affable, and a determined opponent of all government regulation, he was typical of the pioneer railroad builders in the United States.

INGE, inzh, **William (Motter)**, American playwright: b. Independence, Kans., May 3, 1913. With four successive hit plays on Broadway during the 1950's, he ranked as one of the foremost playwrights of the contemporary American theater. The critic George Jean Nathan hailed his "faithful observance of life, sharp appreciation of character and gift for beautifully accurate dialogue."

Inge's childhood ambition was to be an actor, and he performed in high school, college, and stock company productions. After majoring in drama at the University of Kansas (B.A., 1935), he abandoned the idea of an acting career to become a teacher. He taught first in a high school and then at Stephens College, Columbia, Mo. Next, he served for three years as drama critic for the *St. Louis Star-Times*. While teaching English in 1947 at Washington University, St. Louis, he wrote his first play, *Farther Off from Heaven*.

At the age of 37, Inge achieved his first stage success with *Come Back, Little Sheba* (1950), which starred Shirley Booth. He followed this with *Picnic* (1953), *Bus Stop* (1955), and *The Dark at the Top of the Stairs* (1957). All of these enjoyed long runs on Broadway and were made into motion pictures. *Picnic*, the story of a handsome wastrel's one-day visit to a small Kansas town, received the Pulitzer Prize and the New York Drama Critics' Circle Award. Two of Inge's later efforts—*A Loss of Roses* (1959) and *Natural Affection* (1963)—drew unfavorable reviews and closed after brief engagements. Between those failures, he moved to Hollywood, where he wrote the script for the film *Splendor in the Grass*. This movie won an Academy Award for the best original screenplay of 1961.

INGE, ing, **William Ralph**, English clergyman and author: b. Crayke, Yorkshire, England, June 6, 1860; d. Wallingford, Berkshire, Feb. 26, 1954. The son of William Inge, provost of Worcester College, Oxford, he was educated at Eton College and at King's College, Cambridge, where he made a brilliant record. He then served as assistant master of Eton, 1884–1888, and from 1886 to 1888 he was, as well, a fellow of King's College; from 1889 to 1904 he was a fellow and tutor of Hertford College, Oxford. Subsequently he served as vicar of All Saints', Ennismore Gardens, London, 1905–1907; became Lady Margaret professor of divinity and a fellow of Jesus College, Cambridge, 1907–1911; and in 1911 was appointed 91st dean of St. Paul's Cathedral, Lon-

don, a post he continued to occupy until 1934.

Through his lectures, sermons, and writings, expressing a frequently nonconformist view of both religious and secular topics, Inge became a nationally known figure, and his views were widely sought. Critically outspoken and a consistent foe of cant and hypocrisy, he so pessimistically regretted the course of modern times that he came to be called "the gloomy dean." Inge also took a great interest in mysticism and investigated extensively the relations between Christianity and Greek philosophy.

Among his numerous books are the following: *Christian Mysticism* (1899); *Studies of English Mystics* (1906); *The Philosophy of Plotinus* (1918); *The Platonic Tradition* (1926); *The Church in the World* (1927); *Christian Ethics and Modern Problems* (1930); *Our Present Discontents* (1938); and *Mysticism in Religion* (1947).

INGEBORG, ĕng'ĕ-börg (Fr. INGEBURGE, ān-zhĕ-bŭrzh', or INGELBURGE, ān-zhĕl-bŭrzh'), queen of France: b. Denmark, c. 1176, d. Corbeil, France, July 21, 1236. Daughter of King Valdemar I the Great of Denmark and sister of King Canute VI of Denmark, she was married on Aug. 14, 1193, to King Philip II Augustus of France, who on the day following the marriage took an intense dislike to her, despite her youth and beauty, and attempted to have the marriage annulled. He imprisoned Ingeborg in the convent of Cysoing, in the diocese of Tournai. A council of barons and clergy at Compiègne (1193) pronounced an annulment of the marriage, but Popes Celestine III and Innocent III took the part of Ingeborg, and, when Philip married Agnes of Meran in 1196, he was excommunicated and his kingdom was put under an interdict. Having need of the pope's aid, Philip made a pretense of submitting before the Council of Soissons in 1201, but still did not free Ingeborg. Eventually, in 1213, the king was reconciled to Ingeborg, whom he released from the castle of Étampes, to which she had been confined for the preceding 12 years, and restored her rights. After the death of Philip in 1223, Ingeborg lived in retreat at the priory of St. Jean at Corbeil.

INGELOW, in'jĕ-lō, **Jean**, English poet and novelist: b. Boston, Lincolnshire, England, March 17, 1820; d. London, July 20, 1897. Her first work, *A Rhyming Chronicle of Incidents and Feelings*, appeared anonymously in 1850 and, like her later poetry, included recollections of her childhood in Lincolnshire. Not until the publication of her *Poems* in 1863 did she attract much public attention; but this volume won enthusiastic critical praise and public approval and by 1879 it had passed through 23 editions. The best-known poems in this volume were *High Tide on the Coast of Lincolnshire, 1571*, *Divided*, and *Supper at the Mill*. She published further poems in *A Story of Doom* (1867); *Monitions of the Unseen* (1871); *The Shepherd Lady and Other Poems* (1876); and *Poems of the Old Days and the New* (1885). The influence of William Wordsworth and Alfred, Lord Tennyson, is marked in her poetry, which is characterized by acute observations of nature and a deep sympathy for common life. She was hailed in the 19th century for her lyric gifts, and several of her poems were set to music.

She also wrote many children's stories, usually under the pen name "Orris." Among them are *Studies for Stories* (1864); *Stories Told to a Child* (1865); *A Sister's Bye-Hours* (1868); and

Mopsa, the Fairy (1869). Her novels, once popular, are no longer read; they include *Off the Skelligs* (4 vols., 1872); *Fated to be Free* (3 vols., 1875); *Sarah de Berenger* (3 vols., 1879); *Don John: A Story* (3 vols., 1881); and *John Jerome* (1886).

INGEMANN, ɛŋ'ĕ-măn, **Bernhard Severin**, Danish poet and novelist: b. Torkildstrup, Falster, Denmark, May 28, 1789; d. Sorø, Zealand, Feb. 24, 1862. While still a student at the University of Copenhagen, he published his first poems, which were of a dreamy, melancholy nature and were filled with a sickly mysticism, showing markedly the influence of German romanticism. He subsequently published a long allegorical poem and several plays, of which *Blanca* (1815), a tragedy, was the most popular.

In 1822, Ingemann accepted the chair of Danish language and literature at the Academy of Sorø. Inspired by the success of Sir Walter Scott in his Waverley novels and anxious to rouse his country to renewed national pride after the defeats of the Napoleonic Wars and the loss of Norway, he turned to the historical novel, taking his subjects and characters from Danish history. Although his historical romances were frequently inaccurate in detail, they were written with such verve and had such a national flavor that they became very popular. Among these historical romances were the following: *Valdemar Seier* (1826; Eng. tr., *Waldemar, Surnamed Seir, or the Victorious*, 1841); *Erik Menveds Barndom* (1828; Eng. tr., *The Childhood of King Erik Menved*, 1846); *Kong Erik og de Fredløse* (1833; Eng. tr., *King Erik and the Outlaws*, 1843); *Prinds Otto af Danmark* (1835; *Prince Otto of Denmark*); Achieving great popularity, too, were the religious poems of pious innocence in *Morgen og Aftensange* (1839; *Morning and Afternoon Songs*) and the earlier epic poem *Valdemar den Store og hans Moend* (1824; *Waldemar the Great and His Men*). His collected works in 41 volumes were published in Copenhagen (1843-65).

INGENHOUSZ, ɪŋ'ĕn-hous, **Jan**, Dutch physician and scientist: b. Breda, the Netherlands, Dec. 8, 1730; d. Bowood, near Chippenham, Wiltshire, England, Sept. 7, 1799. Educated in medicine at Louvain, he also studied subsequently at the universities of Leiden, Paris, and Edinburgh. After practicing in the Netherlands for six years, he went to London in 1764 or 1765, where he utilized extensively the new discovery of smallpox inoculations. Going to Vienna to inoculate members of the Austrian imperial family, Ingenhousz was rewarded in 1769 with a lifetime pension and was made aulic counselor and body physician to Emperor Joseph II and Maria Theresa.

In 1779 he returned to London and was elected a fellow of the Royal Society, having already contributed several treatises to its *Philosophical Transactions*. In addition to his papers contributed to the Royal Society, which were concerned with electricity and magnetism and atmospheric gases, Ingenhousz wrote the important *Experiments on Vegetables, discovering their great Power of purifying the common Air in Sunshine, but injuring it in the Shade or at Night* (1779), which contained the discovery of the carbon dioxide-oxygen respiration cycle of plants. A collection of his scientific papers was published as *Nouvelles expériences et observations sur divers objets de physique* (2 vols., 1785-89).

INGENIEROS, ɛn-hă-nyă'rôs, **José**, Argentinian psychiatrist, sociologist, and philosopher: b. Buenos Aires, Argentina, April 24, 1877; d. there, Nov. 1, 1925. After receiving his medical degree in 1900 from the University of Buenos Aires, he specialized in the study of problems of nervous and mental pathology. He became director of the psychopathic wards of the hospitals of Buenos Aires in 1901 and was named professor of experimental psychology in the Faculty of Medicine of the University of Buenos Aires in 1904. His clinical work soon led him to the study of criminal anthropology and to oppose the widely accepted views of the Italian criminologist Cesare Lombroso. In 1907, Ingenieros founded the Buenos Aires Institute of Criminology. His later interests were primarily in the field of the history of philosophy, in which he was a disciple of Auguste Comte and Herbert Spencer, and he became one of the leaders of positivist thought in Latin America. Ingenieros served as editorial director of *Archivos de psiquiatria y criminologia* from 1902 to 1913 and of *Revista de filosofia* from 1915 until his death. Among his outstanding works are the following: *La psicopatologia en el arte* (1902); *La simulación de la locura* (1903); *El hombre mediocre* (1913); *Principios de psicología biológica* (1913); and *La evolución de las ideas argentinas* (2 vols., 1918-20).

INGENU, L', lăn-zhă-nü', a satirical romance by Voltaire, was published first in 1767. *L'ingénu* tells the story of Hercule de Kerkabon, who comes with all the virtues of uncorrupted nature from the land of the Hurons to Europe, where he runs afoul of the prejudices and customs, as well as the vices, of civilized society. Finally he learns that he must take the world as it is.

INGERMANNLAND, ɪŋ'ĕr-măn-lănd, or **INGRIA**, ɪŋ'ĕr-ă (Russ. INGRĬYA), ancient district of the Soviet Union, is located between Lake Ladoga and Lake Peipus in Leningrad Oblast, Russian Soviet Federated Socialist Republic. At one time part of the principality of Novgorod, the region was long in dispute between Sweden and Russia. It was taken by Gustavus II Adolphus of Sweden in 1617 and was occupied in 1703 by Peter I the Great of Russia, who in 1708 created a *guberniya*, or administrative district, of this name (renamed St. Petersburg in 1710). Ingermanland, which includes the present city of Leningrad, was annexed permanently to Russia by the Treaty of Nystad in 1721.

INGERSOLL, ɪŋ'ĕr-sŏl, **Charles Jared**, American lawyer and statesman: b. Philadelphia, Pa., Oct. 3, 1782; d. there, May 14, 1862. Growing up in Philadelphia during the early years of the young republic and having before him the examples of public service of his father and grandfather, both named Jared Ingersoll (qq.v.), he moved quite naturally toward a legal and political career. He left Princeton College in 1799 before completing his courses, and turned to the study of law and the writing of verse and drama. His tragedy, *Edwy and Elgiva*, was produced in Philadelphia in 1801.

Ingersoll's early travel in Europe probably helped to change the Federalist views wherein he had been nurtured, for in his first book, written after his return, *A View of the Rights and Wrongs, Power and Policy, of the United States*

of America (1808), he took an anti-Federalist and anti-British approach to foreign relations. In 1810 he followed this book with *Inchiquin, the Jesuit's Letters*, which attacked the comments of British travelers on the United States and helped to arouse a feeling of national self-sufficiency.

Leaving Congress, in which he had served one term (1813-1815) as a Jeffersonian Republican, Ingersoll became United States district attorney for Pennsylvania, an office which he held from 1815 to 1829, and in 1830-1831 a Pennsylvania state assemblyman. His paper on "The Influence of America on the Mind," given before the American Philosophical Society in 1823, was widely read at home and abroad. He published, also, *Julian: A Tragedy* in 1831. During the dispute for renewal of the charter of the Second Bank of the United States, Ingersoll approved President Andrew Jackson's course and helped to draft the subtreasury plan. He also favored limitations on corporation powers and opposed the interpretation of charters as irrevocable contracts, which was so decided in 1819 by the Supreme Court in the celebrated Dartmouth College Case (q.v.).

Ingersoll was nominated for Congress by the Jacksonian Democrats of Pennsylvania in 1837 and 1838, but failed to gain election; however, in 1840, he was elected and continued in the House of Representatives until 1849. In the House he held the important post of chairman of the Foreign Affairs Committee and played a prominent part in the annexation of Texas. He opposed the extreme Northern antislavery view, took a leading role in the debates on the sectional controversies, and frequently espoused causes unpopular among his own social group. He also wrote a significant history of the War of 1812, which appeared in four volumes under two titles: *Historical Sketch of the Second War Between the United States of America and Great Britain* (2 vols., 1845-49) and *History of the Second War Between the United States of America and Great Britain* (2 vols., 1852); and his *Recollections* (2 vols., 1861).

INGERSOLL, Jared, American public official: b. Milford, Conn., 1722; d. New Haven, Conn., Aug. 25, 1781. Upon graduating from Yale College in 1742, he studied law and soon established a legal practice in New Haven, becoming very successful in his profession. In 1751 he was named king's attorney for the county of New Haven. From 1758 to 1761 and again in 1764 he served as London agent for the colony. Though he was at first opposed to the proposals for a stamp tax on the colonies, Ingersoll soon came to feel that such a measure was justified and worked to make it as little objectionable as possible to the American colonists. After passage of the Stamp Act (1765), Prime Minister George Grenville appointed Ingersoll stamp master for Connecticut, Ingersoll accepting on the advice of Benjamin Franklin. But the colonists were aroused, riots and burnings ensued, and, like most of the other stamp agents, Ingersoll was forced by mob action to resign his post. He subsequently retired to the position of justice of the peace in New Haven and continued his law practice. In 1768 he was appointed judge of a court of vice admiralty with its seat at Philadelphia, where he lived from 1771 until 1777, when on the approach of Lieut. Gen. Sir William Howe he was, as a Loyalist, forced by the American Patriots to leave and to return on parole to New Haven. There he spent the remainder of his life.

INGERSOLL, Jared, American lawyer: b. New Haven, Conn., Oct. 27, 1749; d. Philadelphia, Pa., Oct. 31, 1822. A few years after graduation from Yale College in 1766, he moved to Philadelphia, where his father Jared Ingersoll (q.v.) was a judge in the vice admiralty courts, to pursue the study of law, which he continued after July 1773 at the Middle Temple in London. During his stay in England he renounced his father's Loyalist views and espoused the cause of the colonies. Returning to Philadelphia, after about three years in England and nearly two years on the Continent, Ingersoll quickly won for himself a position as a leading lawyer. In 1791 he was admitted to practice before the Supreme Court of the United States.

In the meantime Ingersoll held various public offices. In 1780-1781 he served in the Continental Congress and in 1787 he represented Pennsylvania at the Constitutional Convention. He was also attorney general of Pennsylvania from 1790 to 1799 and from 1811 to 1817, city solicitor of Philadelphia from 1798 to 1801, and United States district attorney for Pennsylvania in 1800-1801. The Federalist Party in 1812 nominated Ingersoll for the vice presidency of the United States on a ticket headed by DeWitt Clinton, but the Federalist's candidates were defeated by their Republican opponents, James Madison and Elbridge Gerry. From March 1821 until his death he presided over the district court of the city and county of Philadelphia.

INGERSOLL, Robert Green, American lawyer, lecturer, and author: b. Dresden, N.Y., Aug. 11, 1833; d. Dobbs Ferry, N.Y., July 21, 1899. The son of an orthodox Congregational minister, he was educated in various towns in Ohio, Wisconsin, and Illinois, where his father preached. He was admitted to the bar in 1854 in Illinois, practicing first at Shawneetown, Ill., and then at Peoria, Ill., and soon became a prominent lawyer and Democrat.

When the Civil War began, Ingersoll recruited the 11th Illinois Volunteer Cavalry Regiment and entered the army as its colonel. He saw action at the battles of Shiloh and Corinth, and on Dec. 18, 1862, he was captured at Lexington, Tenn., by Confederate raiders under Gen. Nathan Bedford Forrest. Soon he was paroled and given command of a camp, but, seeing no possibility of exchange, he resigned from the army in June 1863.

During the war Ingersoll changed his politics from Democratic to Republican. From 1867 to 1869 he served as Republican attorney general of Illinois. He was a delegate to the Republican National Convention of 1876 at Cincinnati, Ohio, where he placed James Gillespie Blaine in nomination for the presidency, terming him "the plumed knight." Ingersoll's nominating speech gave him immediate national recognition and he subsequently became one of the most popular lecturers of the late 19th century in the United States. Although some of his best-known lectures were on such historical personages as Shakespeare, Lincoln, Thomas Paine, Robert Burns, and Voltaire, his most famous lectures concerned more strictly religious subjects; perhaps the most popular were "The Gods" (1872), "Some Mistakes of Moses" (1879), "Why I Am an Agnostic" (1896), "Superstition" (1898), and "The Devil" (1899). In fluent prose, with great dialectic skill, and with seeming "scientific" arguments, he attacked in the tradition of freethinking rationalism what he felt

were the "superstitions" of the Bible and the beliefs of Christianity, earning for himself the epithet "the great agnostic."

Ingersoll was prominent in politics for several years, speaking often at party rallies, and, if he had not given such frequent expression to his agnostic views, he doubtless would have been honored with high offices. He was also a successful trial and corporation lawyer, his most notorious case coming in conjunction with the "star route frauds," in which he gained first a mistrial and later the acquittal (1883) of the leading defendants.

Bibliography.—*The Works of Robert G. Ingersoll*, the complete Dresden edition, was published in 12 volumes (New York 1900; reprinted 1910). His *Letters* were edited by Eva Ingersoll Wakefield (New York 1951). Consult Goldthwaite, Vere, ed., *The Philosophy of Ingersoll* (San Francisco 1906); Kittredge, Herman, E., *Ingersoll: A Biographical Appreciation* (New York 1911); Baker, Isaac, *An Intimate View of Robert G. Ingersoll* (New York 1920); Gorham, Charles T., *Robert G. Ingersoll* (London 1921); Rogers, Cameron, *Colonel Bob Ingersoll* (Garden City, N.Y., 1927); Cohen, Chapman, *Bradlaugh and Ingersoll* (London 1933); Cramer, Clarence H., *Royal Bob* (Indianapolis 1952).

INGERSOLL, Robert Hawley, American merchant and manufacturer: b. Delta, Mich., Dec. 26, 1859; d. Denver, Colo., Sept. 4, 1928. Having only a few years of grammar school education, he worked on his father's farm when a youth and went east when he was 20 years old. In New York City he used his small savings in 1880 to establish himself in the rubber-stamp business; as a side line he produced novelties, such as a toy typewriter and a dollar sewing machine. As his business expanded, he moved into the mail-order and then the chain-store fields. Feeling the need for a single item to stabilize his sales and to serve as a focal point for his manufacturing and sales operations, he introduced in 1892 a cheap watch, supplied by the Waterbury Clock Company; he sold the watch for \$1, eventually under the name "Ingersoll," promoted by the slogan "The Watch That Made the Dollar Famous." By 1919 an estimated 70 million Ingersoll watches had been sold. Three years later the firm went into receivership and was sold to the Waterbury Clock Company, and Ingersoll spent the remaining years of his life promoting a dollar razor strop.

INGERSOLL, Simon, American inventor: b. Stanwich, Conn., March 3, 1818; d. Stamford, Conn., July 24, 1894. Educated in the country schools of his birthplace, he soon became locally recognized for his mechanical ingenuity, though little is known of his early years. His first patent, in 1858, was for a steam engine rotating shaft; he also built in Stamford, Conn., a workable steam wagon. Ingersoll obtained patents on a gate latch, a friction clutch, and a spring scale in the 1860's. Unable, however, to support himself as an inventor, he turned to truck gardening about 1870, in which he had previously engaged, and had a stall in the Fulton Market, New York City. There he was encouraged by a contractor to invent a rock drill, which he succeeded in doing and patenting in 1871, later selling his patent rights to José F. Navarro of New York City. He returned to Stamford and became a partner in a machine shop, where he worked the rest of his life, especially on rock drills and guns. His inventions brought him no great return, and he died nearly destitute.

INGERSOLL, town, Ontario, Canada, located in Oxford County, on the Thames River, 18

miles east of London. It is the center of a mixed farming district well known for its dairy products. The industrial establishments of the town include furniture and hardware plants and flour mills. Fertilizers and lumber products are also made. Ingersoll is served by the Canadian National and Canadian Pacific railways and is situated at the junction of two highways. It is named for Maj. Thomas Ingersoll, who settled here from Massachusetts in 1793. Laura Secord (q.v.), heroine of an episode in the War of 1812, was Ingersoll's daughter. Pop. 6,874.

INGHAM, ing'am, Benjamin, English evangelist: b. Ossett, Yorkshire, England, June 11, 1712; d. Aberford, Yorkshire, 1772. He received his education at Batley School and at Queen's College, Oxford, from which he was graduated in 1734. In 1735 he was ordained, and, becoming associated with John and Charles Wesley, went with them to Georgia, remaining 13 months. In 1738 he went with John Wesley on a visit to the Moravians in Germany and became so strongly attached to their doctrines that he broke with the Wesleys and founded in Yorkshire several congregations of what were known as "Moravian Methodists," but more commonly as "Inghamites." He endeavored to unite in this organization the chief doctrines of the Moravians and Methodists, and so successful was he as bishop or general overseer that in a few years there were about 80 of these congregations in England. In 1754 he broke his ties with the Moravians, and his congregations became practically independent. After he had adopted some of the mystical views of Robert Sandeman in 1760, the greater part of his followers deserted him. Only about 13 of the Inghamite churches followed him into the Sandemanian sect; the rest were absorbed by other sects, especially the Methodists. Ingham wrote *A Discourse on the Faith and Hope of the Gospel* (1763).

INGHAM, Charles Cromwell, American painter: b. Dublin, Ireland, 1796; d. New York, N.Y., Dec. 10, 1863. After a short period of study at the Royal Dublin Society, he studied for some years with William Cuming, a Dublin portraitist. While still a student he painted a *Death of Cleopatra*, which he later exhibited, to general acclaim, at the American Academy of Fine Arts, New York City. Ingham came to the United States in 1816, settling in New York City, and devoted himself to portraits and miniatures, especially of women and children. He also painted certain prominent public figures, including Governor DeWitt Clinton and the marquis de Lafayette (both portraits in the New York Historical Society collection). In 1826 he helped to found the National Academy of Design and subsequently served as its vice president. Among his other paintings is *The Flower Girl* (1846), in The Metropolitan Museum of Art, New York City.

INGLE, ing'g'l, Richard, English sea captain: b. in England, 1609; d. probably in Maryland, after 1653. When the English Civil War began, Ingle was engaged in the Maryland tobacco trade. He espoused the parliamentary cause and in 1644, together with William Claiborne, expelled Governor Leonard Calvert from Maryland. The latter, however, gathered forces from Virginia and repossessed Maryland in 1646. During his rule Ingle committed numerous outrages against the Marylanders. Charges were made against him in Eng-

land, where he defended himself on the ground that he had acted from religious motives and had plundered only "papists." When the proprietary government was restored in 1646, Ingle was not included in the general amnesty granted to the other rebels. On Nov. 14, 1653, he petitioned for a share of prize money, and thereafter disappears from history.

Consult Ingle, Edward, *Capt. Richard Ingle, the Maryland Pirate and Rebel, 1642-1653* (Baltimore 1884).

INGLEBY, ینگ'g'l-bī, Clement Mansfield, English writer and Shakespearean critic: b. Edgbaston, near Birmingham, Oct. 29, 1823; d. Ilford, Essex, Sept. 26, 1886. He was educated at Trinity College, Cambridge University, receiving his B.A. degree in 1847 and his M.A. in 1850. He practiced law with his father, a well-known Birmingham solicitor, until 1859, when he moved to Ilford, near London, and devoted himself to writing on metaphysical and literary subjects. His best-known works are his Shakespearean studies, among which are *The Shakespeare Fabrication* (1859) and *A Complete View of the Shakespeare Controversy* (1861), both on the literary forgeries of John Payne Collier (q.v.); *Centurie of Prayse* (1874); *The Still Lion* (1874), republished as *Shakespeare Hermeneutics* (1875); *Shakespeare: The Man and the Book* (1877-1881); and an edition of *Cymbeline* (1886). He also wrote *Outlines of Theoretical Logic* (1856) and *Introduction to Metaphysic* (1864-1869).

INGLEFIELD, Sir Edward Augustus, British naval officer and explorer: b. Cheltenham, March 27, 1820; d. London, Sept. 5, 1894. He studied at the Royal Naval College, Portsmouth, from 1832 to 1834, when he went to sea. In 1840 he participated in naval operations off the coast of Syria, and then served in the West Indies. In 1845 he was promoted to the rank of commander. He commanded the yacht *Isabella* on a cruise to Smith Sound in 1852 in search of Sir John Franklin (q.v.). On his return to England, he published an account of this cruise, *A Summer Search for Sir John Franklin* (1853), and was made a fellow of the Royal Society and awarded the gold medal of the Royal Geographical Society. As commander of the *Phoenix*, he made two more trips to the Arctic: one in 1853 to relieve Sir Edward Belcher, and one in 1854 in which he rescued part of the Belcher expedition and made a last attempt to find Franklin. He fought in the Black Sea during the Crimean War. In 1869 he was promoted to the rank of rear admiral. He served as second in command in the Mediterranean from 1872 to 1875, when he became a vice admiral. He was commander in chief in the North Atlantic in 1878-1879. He was knighted in 1877, and two years later was promoted to the rank of admiral. He retired in 1888. Inglefield invented the anchor known by his name and the hydraulic steering gear.

INGLEWOOD, city, California, situated in Los Angeles County, at an altitude of 115 feet, 10 miles southwest of downtown Los Angeles, of which it is a residential suburb. It is served by the Atchison, Topeka and Santa Fe and the Pacific Electric railroads; the Los Angeles International Airport is nearby. The city has chin-chilla farms, oil refineries, and plants producing airplanes, machinery, metal products, pottery, plastics, and furniture. Founded in 1873 by

Daniel Freeman, Inglewood was laid out in 1887 and incorporated in 1908. It is governed by a mayor and council. Pop. 63,390.

INGLIS, ینگ'g'iz, Charles, British prelate: b. County Donegal, Ireland, 1734; d. Halifax, Nova Scotia, Feb. 26, 1816. Educated in Ireland, he went to Pennsylvania in 1755 and for three years taught school at Lancaster. In 1758 he went to England, where he was ordained in the Church of England. In 1759 he was assigned to a missionary post in Dover, Del., where he remained until 1765, when he became assistant to the rector of Trinity Church, New York City. He became known for his advocacy of the establishment of an American episcopacy and for his work on behalf of the conversion of the Indians. He received an honorary M.A. degree from King's College (now Columbia University) in 1767, and about three years later became one of its governors. In 1770 he received an honorary M.A. degree from Oxford University, and in 1778 an honorary D.D. A stout Loyalist, he refused to omit from the service at Trinity prayers for the king and the royal family, and after the occupation of New York City by George Washington in 1776, he retired for a time to Flushing, Long Island. Returning to New York City in 1777, he became rector of Trinity. When the British evacuated the city in 1783, he went at first to Halifax, Nova Scotia, and then to England, where, in 1787, he was consecrated bishop of Nova Scotia, the first colonial bishop of the Church of England. He went to the colony soon thereafter, was made a member of its council in 1809, and remained there until his death.

His son, JOHN INGLIS (b. New York City, 1777; d. London, England, Oct. 27, 1850), was also a clergyman. He was educated at King's College, Windsor, Nova Scotia; became a deacon in 1801; and assisted his father until 1816, when he went to England. In 1839 he was consecrated third Anglican bishop of Nova Scotia. Inglis was a benefactor of King's College, and he opposed the Anglican test required as a condition for entrance to that institution.

SIR JOHN EARDLEY WILMOT INGLIS (b. Nova Scotia, Nov. 15, 1814; d. Hamburg, Germany, Sept. 27, 1862), son of the preceding, was a soldier. His entire career was passed in the British 32d Foot Infantry, which he joined in 1833. He served in Canada during the insurrection of 1837, and in the Punjab in 1848-1849. He was in command of his regiment at the outbreak of the Indian Mutiny in 1857. Inglis is celebrated chiefly for his brave defense of Lucknow, whose garrison he commanded from July 2 to Sept. 26, 1857. For his services he was knighted and promoted to major general.

INGOLDSBY LEGENDS, The, a collection of tales, mostly in verse and nearly all humorous, by the Rev. Richard Harris Barham (q.v.), whose pseudonym was Thomas Ingoldsby. They appeared in *Bentley's Miscellany* in 1837-1840, and were collected in book form in 1840, with a second and third series in 1847. The literary sources of the tales are extremely varied, ranging from saints' legends, medieval chronicles, and Kentish traditions to Jean de La Fontaine's *Contes*, Johann Wolfgang von Goethe's *Zauberlehrling*, and Friedrich de La Motte-Fouqué's *Undine*, so that they offer the richest mixture of witchcraft,

ghosts, magic, and demonology, with legal, genealogical, heraldic, ecclesiastical, and gastronomic history and anachronisms. Its careful technique in the details of narrative and description is in the tradition of Laurence Sterne; and its rollicking masculine fun is the peculiarly English fun of a bygone day of roast beef, puddings, and ale, a hierarchical social order, and a gentlemanly acquaintance with the classics. Its defects are the often flippant handling of themes essentially serious; the rarity of its genuine wit or humor—their place being generally occupied by fun and volubility; its employment of digression beyond the point where digression ceases to amuse and begins to bore; and its outworn insularity and prejudices. These penalties it pays for smacking so racily of its time and its land. The book takes the gauge of early Victorian England relaxing over the nuts and wine; yet, all detractions made, does it so perfectly as to make itself the permanent model of its genre.

SAMUEL LEE WOLFF.

INGOLSTADT, ینگول-ستادت, Ger. ینگول-شتادت, city, Germany, situated in Bavaria on the Danube River, 43 miles north of Munich. It is a rail and trade center, with such industries as woodworking, brewing, and the manufacture of textiles, automobiles, and tobacco. First mentioned in the 8th century, it was chartered in 1250 and fortified in 1539. From 1392 to 1447 the city was the residence of the dukes of Ingolstadt. The Herzogsschloss (Ducal Palace), begun c. 1400, now a museum, is one of the best secular creations of Gothic art in Germany. Ingolstadt's walls, distinguished by fine towers and gates, were razed by the French in 1800, but were rebuilt during 1828-1840. Ingolstadt was the seat of a university founded in 1472, but the university was removed to Landshut in 1800 and to Munich in 1826, where it is now located. The city suffered some damage in World War II and was captured by the United States Army in the spring of 1945. Pop. (1950) 40,270.

INGRAHAM, ینگرا-هام, **Duncan Nathaniel**, American naval officer: b. Charleston, S.C., Dec. 6, 1802; d. there, Oct. 16, 1891. He entered the United States Navy as a midshipman at the age of nine and served during the War of 1812 and in the Mexican War. In June 1853, while commanding the sloop of war *St. Louis* in Mediterranean waters, he arrived at Smyrna (now İzmir), Turkey, while Martin Koszta, a Hungarian political refugee, was imprisoned aboard an Austrian ship in the harbor, after the Austrians had seized him in Turkey. Koszta previously had declared in New York City his intention of becoming a United States citizen. Under instruction from the United States chargé d'affaires in Constantinople (now İstanbul), Ingraham secured Koszta's release by threat of force, and his action was upheld subsequently by the United States government. (See also **KOSZTA AFFAIR**.)

On Ingraham's return to the United States he was received with acclaim, was raised to the rank of captain in 1855, and acted for over four years as chief of the Bureau of Ordnance of the Department of the Navy. In 1861 he resigned from the service, entered the Confederate Navy, became its chief of ordnance at Richmond, Va., and then commanded its flotilla along the coast of South Carolina from November 1861 to March

1863, after which he was in charge of the naval station at Charleston until the end of the war, when he retired.

INGRAHAM, **Joseph Holt**, American novelist and clergyman: b. Portland, Me., Jan. 25 or 26, 1809; d. Holly Springs, Miss., Dec. 18, 1860. As a youth he went to sea, later becoming a teacher in Washington, Miss. He began to write a sensational type of fiction, and for some years his prolific pen produced such works as *Lafitte: The Pirate of the Gulf* (2 vols., 1836); *Burton, or The Sieges* (2 vols., 1838); and *Scarlet Feather, or The Young Chief of the Abenagues* (1845). About 1849 he began to study theology and was ordained a priest of the Protestant Episcopal Church in 1852. From 1852 to 1858 he served churches in Mississippi, Alabama, and Tennessee, becoming rector of Christ Church, Holly Springs, Miss., in 1859. During this period he also wrote romances of Biblical times, including *The Prince of the House of David* (1855); *The Pillar of Fire* (1859); and *The Throne of David* (1860). Meanwhile he tried to suppress the earlier works. Ingraham was killed by the accidental discharge of his own gun.

His son, **PRENTISS INGRAHAM** (1843-1904), was a soldier of fortune and writer of dime novels. After serving with the Confederate Army in the Civil War, he saw service in many foreign lands—including Austria, in its war with Prussia (1866), and Cuba, in its first war for independence (1868-1878). These experiences, together with his far-flung travels, formed the basis for his more than 600 novels and other writings. *Buffalo Bill's Tough Tussle* (1895) and more than 200 other stories were based on the career of his friend, William Frederick Cody (q.v.), called "Buffalo Bill." Among his other tales were *Zuleikah: A Story of Crete* (1887); *An American Monte Cristo* (1891); and *The Girl Rough Riders* (1903).

INGRAIN. See **HOSIERY INDUSTRY AND HOSE—Hosiery Terms**.

INGRAM, ینگرام, **Arthur Foley Winington**, English prelate: b. Stanford-on-Teme, Worcestershire, England, Jan. 26, 1858; d. Upton-on-Severn, Worcestershire, May 26, 1946. Educated at Marlborough and Keble colleges, Oxford, he was ordained in 1884, became canon of St. Paul's Cathedral and bishop of Stepney, London, in 1897, and was then bishop of London for 38 years (1901-1939), the longest tenure since the 17th century. A man of pervading democracy, kindness, and personal charm, Bishop Ingram became famous for his religious and social work in London's East End slum areas, an activity stemming chiefly from his appointment as head of Oxford House, Bethnal Green (an organization of religious and social workers from the university) in 1889, when he delighted in ringing doorbells to bring his message to the poor. His simplicity and his human characteristics, including athletic prowess, added to his popularity. In World War I he visited the Salonika and Western fronts; in 1926-1927, at 68, he undertook a world missionary tour during which he visited the United States, exemplifying his vitality in a whirlwind of engagements including talks at many universities, tennis with Helen Wills, and golf of fine quality. Among his many religious books, *What a Layman Should Believe* (1938)

reflected his adherence to the high church viewpoint in interpreting Church of England doctrine, while *Fifty Years' Work in London* (1940) described his life mission. He was knighted in 1915.

Consult Colson, Percy, *Life of the Bishop of London*, rev. ed. (London 1939); Carpenter, Spencer C., *Winnington-Ingram* (London 1949).

INGRAM, Frances, American contralto: b. Liverpool, England, Nov. 5, 1888. Brought to the United States at the age of nine, she was educated in Brooklyn, N.Y. In 1912 she made her debut as Lola in *Cavalleria Rusticana* with the Chicago Grand Opera Company. She sang with the Montreal Grand Opera Company (1913-1914); made concert tours in 1914 and 1915; sang with the Chicago company in 1915 and with the Metropolitan Opera Company in 1919. During her career she performed the title role in *Carmen*, that of Azucena in *Il Trovatore*, Ortrud in *Lohegrin*, Amneris in *Aida*, and many others.

INGRAM, John Kells, Irish scholar and writer: b. Temple Carne, County Donegal, Ireland, July 7, 1823; d. Dublin, May 1, 1907. In 1843 he was graduated from Trinity College, Dublin, and in the same year his poem, *The Memory of the Dead* (1798), was anonymously published, soon to become a rallying hymn for the Irish Nationalist cause. Ingram returned to serve Trinity College in several successive capacities, notably as professor of oratory and English literature (1852-1866), regius professor of Greek (1866-1877), librarian (1879-1887), and vice provost (1898-1899). A versatile scholar, he wrote books and periodical articles in the fields of philosophy, science, political economy, and mathematics—and poems, as well. His *History of Political Economy* first appeared in the 9th edition of *Encyclopaedia Britannica* in 1885 and it was revised and published in book form in 1888, going through 5 English editions and undergoing translations into 10 foreign languages. Among his other works are *Outlines of the History of Religion* (1900); *Sonnets and Other Poems* (1900); *Practical Morals* (1904); and *The Final Transition* (1905).

INGRASSIA, êng-gräs'syă, or INGRASSIAS, êng-gräs'syäs, Giovanni Filippo, Sicilian anatomist and physician: b. Regalbuto, Sicily, c. 1510; d. Palermo, Nov. 6, 1580. He studied at the University of Padua, graduating in 1537, and in 1544 became professor of anatomy and practical medicine at the University of Naples. In 1556 or 1563 he returned to his native Sicily and was appointed the island's chief physician, in charge of all medical services. He held this post until his death. During these years he worked to raise standards of public health, taking effective measures to suppress the plague at Palermo in 1575. Although highly esteemed for these efforts, he is principally known for his work in anatomy, especially in osteology and myology. Ingrassia did much valuable work in skull anatomy, including the discovery of the stapes, and he was the first to describe the seminal vesicles. Much of his pioneer work in osteology is contained in the treatise, *In Galeni librum de ossibus doctissima et expectatissima commentaria*, published posthumously in 1603.

INGRES, ăn'gr', Jean Auguste Dominique, French painter: b. Montauban, France, Aug. 29,

1780; d. Paris, Jan. 14, 1867. His father was a musician and sculptor, and the son early showed talent as a violinist. Inspired by the work of Raphael, however, he determined to be a painter, and therefore proceeded to Paris in 1796. There he studied with Jacques Louis David, supporting himself by playing in a theater orchestra. In 1801 he won the Prix de Rome for his painting, *Les ambassadeurs d'Agamemnon* (*The Embassadors of Agamemnon*), but because of the unsettled state of French finances was unable to go to Rome until 1806. After a stay of several years in Rome, he moved to Florence in 1819 and during the period in Italy supported his family by portraiture, producing also a number of other paintings. Among them were *Oedipe et le Sphinx* (*Oedipus and the Sphinx*, 1808) and *Odalisque couchée* (*Reclining Odalisque*, 1814), the latter eventually one of his most popular works. At the time, however, he received scant recognition for any of his paintings. Rejecting romanticism, his art was nevertheless affected by it, often revealing sensuous qualities associated with the romantic spirit. Thus, paradoxically, it was the romantics who first appreciated and accepted his work.

In 1824, Ingres returned to France with the painting, *Vœu de Louis XIII* (*Vow of Louis XIII*), done for the cathedral at Montauban. This work was an immediate success, and he was soon elected to the Institut de France (1825). Remaining in Paris until 1834, he enjoyed brilliant success as a painter, receiving many commissions for portraits and official paintings and attracting a large group of students. During this period he produced the *Apothéose d'Homère* (*Apotheosis of Homer*, 1827), and in the same year the *Odalisque* achieved fame in lithograph form. Ingres was now a leading exponent of conservatism, as opposed to the romanticism of Eugène Delacroix and his followers. He delighted in beauty of line for its own sake, his drawing often revealing a compromise between reality and his ideal of perfect symmetry. To his students he emphasized the importance of line, to the detriment of color. As subjects for inspiration he prescribed classic mythology and sculpture and Raphael's paintings.

Disappointed by the cool reception accorded his *Martyre de St. Symphorien* (*Martyrdom of St. Symphorien*, 1834), he decided to accept the post as director of the Académie de France à Rome. In Rome he continued with such paintings as *Odalisque à l'esclave* (*The Odalisque with the Slave*, 1840) and *Stratonice* (1840). When he returned to France in 1841, he was again hailed with enthusiasm. In 1845 came one of his best portraits, *Mme. d'Haussonville*, followed by the well-known *La source* (1856). Shortly after his death in 1867 the Musée Ingres was founded in Montauban with a large collection of his drawings and paintings. An excellent collection of Ingres' work may also be found in the Musée du Louvre in Paris.

See also PAINTING—Romanticism and Classicism.

Consult Lapauze, Henry, *Ingres: sa vie et son oeuvre* (*Ingres: His Life and Work*, Paris 1911); Hourticq, Louis, *Ingres* (Paris 1928); Pach, Walter, *Ingres* (New York 1939); Wildenstein, Georges, *Ingres* (London 1954).

INHALATION, in-hă-lă'shŭn, the breathing in of air or vapor. This is the physiological process by which oxygen is introduced into the human system. Steam inhalations are employed

in young infants particularly to dilute the sputum in the bronchi and prevent obstruction. Inhalation is the route employed to administer various drugs: notably anesthetic agents, resuscitants, antibiotics, and bronchial dilators. To guard against noxious substances being inhaled in the pulmonary system various inhaler filters have been devised to eliminate ingestion of industrial wastes, dust, silicon, and the products of incomplete combustion. This is an important public health problem.

REAUMUR S. DONNALLY, M.D.

INHAMBANE, ĩn-yămb-ă'ăně, town, Mozambique, overseas province of Portugal, situated on the East African coast on the Mozambique Channel of the Indian Ocean, 230 miles northeast of Lourenço Marques. It is the capital of the District of Inhambane (pop. 1950, 570,089). The town is a port for coastwise shipping, linked by railroad with Inharrime and by air with Lourenço Marques and other points. It exports the products of the region, including sugar, cotton, peanuts, rubber, corn, copra, mafura, and timber; and soap, bricks, tiles, and pottery are manufactured here. Inhambane was founded in the mid-16th century, and in 1834 was captured by tribesmen of Bantu stock (see also *MOZAMBIQUE—Government*). Thereafter the town declined, but it revived near the close of the 19th century. Pop. (1955) 68,117.

INHERITANCE, ĩn-hěr'ĭ-tăns, in law, a term used in a general sense to describe all property, real or personal, passing from a deceased person to others, either under the terms of a will or by operation of law. In this broad sense, any property distributed from a decedent's estate, whether pursuant to his will, or under the local laws of descent and distribution, or in accordance with a judicially approved agreement, constitutes an inheritance. Thus an agreement of brothers to pay their sister annually a sum of money from income of a trust created for them has been held to be an inheritance, where the agreement was made in compromise of the sister's threat to contest their father's will.

In a more limited and technical sense, and as used at common law, the term "inheritance" relates only to real property descending to an heir by operation of law, and not under a will. Thus used, the term excludes devises of real property and all distributions of personal property.

Even in its broad sense the term "inheritance" does not apply to the passage of the share of a joint owner to a surviving joint owner. (See also *JOINT TENANTS*.) Accordingly it has been held that where property is owned by a husband and wife, and the husband dies, the wife does not take the husband's interest by inheritance. It has similarly been held that, where a deceased person has held the record title to property in trust for another, the latter does not acquire the property by inheritance when the trusteeship is terminated by death. See also *DESCENT AND DISTRIBUTION*.

RICHARD L. HIRSHBERG.

INHERITANCE TAX, a term used in a broad sense to describe levies imposed upon the transfer of the property of a decedent at the time of his death. It also includes taxes imposed on property transferred "in contemplation of death," that is, where considerations of death were the predominant motive. It does not include taxes on

other gifts, though these are frequently imposed to prevent avoidance of death duties and are therefore treated as a satellite of the inheritance tax institution. Although insurance may technically involve transfer outside an estate settlement, the proceeds are also usually included in a death tax base.

In the narrower sense inheritance taxes are distinguished from estate taxes, the former based on the transfers by a decedent to specific heirs, the latter on the undivided or aggregate wealth transferred by a decedent to all his heirs. Estate taxes are generally regarded as simpler to administer and more productive of revenue, while inheritance taxes are considered a more refined application of the ability-to-pay principle. In the United States the federal government uses the estate tax exclusively, but the states employ predominantly the inheritance tax. Great Britain formerly used a combination of the two types of levies, but since 1949 it has confined itself to the estate tax.

Although the federal government of the United States had used death taxes as emergency measures during previous periods, it was not until 1916 that the estate tax was added as a permanent feature of its revenue system. State inheritance tax laws in some form date at least to the Pennsylvania law of 1826, but it was not until 1903, in Wisconsin, that graduation according to both size of transfer and relationship of heir to deceased was introduced. Federal encroachment upon what some regarded as the taxing province of the states caused some controversy; it was settled by compromise, under which state taxes within limits may be credited against the federal levy.

Inheritance taxes are supported mainly on the ground that they are in accord with the ability-to-pay principle and have a salutary effect on the distribution of wealth. They are said to make for "cradle equality," that is, to reduce the head start of youth who inherit what others have earned. These taxes are criticized on the score that they are especially inimical to the accumulation of capital—"grinding the nation's seed corn"—and that they dissolve socially desirable family-owned businesses.

Special features of death tax laws are perennial areas of litigation and legislative debate. This is true of gifts in contemplation of death, a status which turns on motivation and is not easily established. Legislative bodies have sought to mitigate the problem by specifying a period before death during which gifts are presumed to be "in contemplation." Gifts and bequests in trust, providing for successive life estates and a remainderman, are another such area; they can be used to cover several generations in one transfer and to extend the period between levies. Finally there are devices for splitting estates to avoid the full brunt of the graduated scale; this problem was compounded in the United States by the adoption of the rule of marital deduction, providing that spouses may succeed to half of an estate tax free.

At the state level, problems of jurisdiction and multiple taxation arise especially in the taxation of intangible property. Such property is now taxed predominantly at the domicile of the deceased, but two or more states may claim such domicile and no satisfactory means of resolving such disputes has been found. States also complain of migration to escape their death taxes; the federal credit has mitigated, but has not

eliminated this problem. Canada, with similar problems, has sought without complete success to nationalize the tax by agreements with the provinces. The same problems on a lesser scale arise between nations, but here they have been mitigated by many international agreements.

Death taxes generally are not major revenue producers and in the United States they provide less than 2 per cent of total tax revenue. This is despite a stiff federal rate schedule ranging from 3 to 77 per cent, the latter on portions of taxable estates above \$10,000,000. Critics blame the high exemption (\$60,000) and the avoidance of the tax, by the above-mentioned splitting and stretching, for this rather unimpressive showing. A death tax as a revenue producer has the inherent limitation that it reaches only part of the national wealth, and at most once in a generation. The persistent interest which the tax invokes is much greater than its yield.

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INHIBITION, ĭn-hĭ-bĭsh'ŭn, in psychology, the restraint of one activity by the presence of a conflicting mental process. This term has received considerable attention. In traditional speculative psychology, the ability of a person to inhibit responses was accounted for by reference to the faculty of the will. Attempts to extort confessions through torture might fail because the victim could, through the use of will power, inhibit both an overt expression of pain and an admission of certain information. Restraints of this sort came to be known as examples of purposeful inhibition. Inability to recall well-known facts, such as might occur when one is emotionally disorganized, were referred to as acts of unintended inhibition.

The first thoroughgoing analysis of the psychology of inhibition was made in 1816 by Johann Friedrich Herbart (q.v.). He taught that ideas have a permanent existence in the mind and that in many cases one idea conflicts with another. The stronger of the two ideas then inhibits the presence of the other in consciousness. The weaker idea, though it continues to remain in the mind, recedes out to the periphery of consciousness. The dynamic interrelations among ideas depend upon the time that they have been in the mind, their intensity, and their quality. According to Herbart, it should be possible to express in an equation the interplay between two ideas, one of which inhibits the other.

Sigmund Freud (q.v.) incorporated some of Herbart's views into his theory of repression. In his early writings Freud taught that, because of excessive repressions or inhibitions, a person may become overwhelmed by anxieties. Toward the end of his life, however, Freud taught that anxieties must be excluded from the conscious mind, lest the individual become disorganized. Only when the defensive, inhibitory barriers against unconscious urges have given way does the person develop a neurosis or a graver mental disorder.

Ivan Petrovich Pavlov (q.v.) investigated some of the mechanics of inhibitory processes in laboratory dogs. He found that if the animal is trained to respond to a regular signal when food is presented, eventually the signal alone will induce salivation. This he termed a simple conditioned response. The dog would be inhibited in responding to any signal other than that regularly

used in the training. When he attempted to train dogs to make conditioned responses to extremely complex situations, some of them lost all their inhibitions. They would growl, tremble, cower, and exhibit many other symptoms of complete disorganization. He had created what he called an experimental neurosis. The condition is somewhat like that in the human being who is in the state popularly called a nervous breakdown. The discriminations and the inhibitions of normal everyday life are replaced by purposeless, disorganized behavior.

The self-protective inhibitions may be weakened by mental disorders, illnesses, or drugs. A mild, quick-acting barbiturate may lower a person's level of inhibitions and may facilitate the disclosure of data which normally would not be revealed. Such information may be helpful to a psychiatrist who wishes to help his patient to understand the unconscious dynamics behind a mental disorder. Other techniques, wholly unethical, are used in disorganizing personality through the destruction of normal inhibitions. Prolonged malnutrition, induction of excessive fatigue, an admixture of kindly and brutal treatment—these are some of the methods used in so-called brainwashing, which, in essence, is the removal of all self-protective inhibitory controls from its victim.

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INIA, ĭn'ĭ-ă, a genus of toothed freshwater cetaceans similar to dolphins (family Delphinidae), but belonging to the allied family, Platanistidae, subfamily Iniinae. The single species (*I. geoffrensis*), the Amazon River dolphin, also called boto, is found in some of the upper tributaries of the Amazon. It measures about 6 to 9 feet in length and has a long narrow snout with 26 to 33 peglike teeth in each side of the jaw (total 104 to 132). The color varies widely from light pink to gray or black, and is frequently darker above and lighter below. The dorsal fin, located on the rear half of the back, is long and low. Fish is its principal food.

R. L. PETERSON.

ININI, ĭ-nĕ-nĕ', district, French Guiana, bounded on the north by the coastal strip of French Guiana, on the east and south by Brazil, and on the west by Surinam. The boundary with Brazil is formed by the Oyapock River on the east and the Tumuc-Humac Mountains on the south, while the Surinam boundary is formed by the Maroni River. It is a densely forested, sparsely populated area of 30,300 square miles with many swift, but navigable, rivers. Its products include rosewood and other cabinet woods, balata gum, and alluvial gold. There are no towns, only a few small outposts. Formerly separately administered by a decree of 1930, it was reunited with the French overseas Department of Guiana by a law of 1946 and was made a separate *arrondissement* (district) in 1951. The inhabitants are largely Negroes, mixed breeds, and Indians. Pop. (1954) 3,234.

INITIAL DIP. See DIP.

INITIATION, ĭ-nĭsh-ĭ-ă'shŭn, the rites with which an individual is admitted to a society or social group, or which mark the transition from one state to another, as passing into maturity or

into a special state of sanctity. Among primitive peoples the ceremonies initiating male children to adult status are most widespread and assume paramount importance. Such ceremonies take place at about the time of puberty, but primitive thought emphasizes the social importance of this transition and the new privileges and responsibilities which are involved. Thus the youth must demonstrate his ability to undertake these responsibilities by proving his endurance and courage. He is tested by physical pain or discomfort, as in fasting, whipping, knocking out a front tooth, circumcision, or other permanent mutilation of the body. The novices are usually initiated in a group secluded from women and uninitiated children, for now the elders give instruction in the duties of a man and reveal the religious mysteries of the tribe. Thus, among some tribes of American Indians, the initiates learn that the dancing "spirits," whose appearances they had feared as children, were in reality masked men. Women and the uninitiated may not witness any of these ceremonies on pain of death and they may not know the magical mysteries which form so important a part of the tribe's religious life.

Among many savage tribes the concept of death and rebirth is associated with this period of seclusion and initiation. In some tribes of Australia and New Guinea the youths are swallowed and disgorged by a mythical monster, whose roar is produced by men swinging bull-roarers. Women and children who hear the humming sound believe that this is the voice of the monster. Among tribes which practice totemism the ceremony of death and rebirth is associated with the totem. The novice dies as a human being, but comes to life as an animal, the soul of the totem animal being now in his body, and thus he is related and linked in a special way with animals of that species.

In primitive societies initiation to special groups generally involves ceremonies similar to those at puberty. For instance, some religious associations of North American Indians are open only to candidates who have gone through the ceremony of death and resurrection.

INITIATIVE, i-nish'î-tiv, in government, the method by which voters themselves may propose and enact a new law. The process was first developed in Switzerland. Early in United States history the initiative was inaugurated by some states for the purpose of making constitutional changes, but North Dakota was the first to allow it for general lawmaking (1898). Nineteen states have followed suit, Mississippi being the last state to adopt it (1916).

The procedure calls for a petition containing a draft of the proposed law and signed by a specified number of voters, the number varying according to the laws of the several states. Often the number is expressed as a certain percentage of the registered voters. If the petition qualifies, the proposed act is placed on the ballot, in some states, while in others it is submitted to the legislature first, being set before the voters only if defeated by the legislature. If a sufficient number of voters approve the measure, it then becomes law. See also **REFERENDUM**.

INJECTION, in-jêk'shûn, the process by which fluids are administered to the animal organism, primarily human. Ordinarily such fluids are given by a glass syringe, consisting of a barrel

and a plunger, the barrel marked off in cubic centimeters and possessing a tip for insertion in the hub of a stainless steel needle. Special types of syringes include the tuberculin, calibrated in hundredths of a cubic centimeter for allergy testing; and the insulin syringe, where the administered dose is written on the barrel. Through the use of a special metal tip, the Luer lock, the needle may be locked to the syringe by giving it a quarter turn.

There are three general types of injections: The first, called hypodermic, is an injection given under the skin (subcutaneously) in the soft tissues. This type is used for common sedatives, such as the barbiturates and morphine; routine inoculations against infectious diseases, such as typhoid, yellow fever, and tetanus; and anti-allergenic inoculations, for example, those against ragweed, tree, or grass pollens. The second type of injection, the intramuscular, is the route used for more painful and longer-acting medications, such as the B-complex vitamins, the antibiotics (penicillin and streptomycin), the heavy metals (the mercurial diuretics), and oil suspensions (notably the male and female hormones). The last usual type of injection is by vein (intravenous). The solutions are physiological, so as to be compatible with blood. They are packed in sterile glass bottles, fitted with an air intake tube and a drip chamber to measure flow, and are fed to the vein by gravity through disposable plastic tubing. Intravenous injections are invaluable in restoring blood volume with plasma and in maintaining body electrolytes.

REAUMUR S. DONNALLY, M.D.

INJUNCTION, in-jûngk'shûn, in law, an order or command of a court prohibiting or requiring the doing of certain acts. It is primarily a preventive remedy directed against future acts, but it may also be aimed toward the reversal of past actions and the restoration of the status quo. Although the issuance of injunctions is within the inherent power of equity courts, statutes sometimes define or restrict the remedy and specify the procedural steps necessary to obtain, modify, or dissolve an injunction.

Classification.—Injunctions may be classified, according to their effect, as prohibitory or mandatory. A prohibitory injunction restrains the commission or the continuance of an act. A mandatory injunction, on the other hand, requires the taking of affirmative action. Such injunctions are used to compel the abatement of nuisances, the removal of buildings and obstructions, the transfer of title or possession, and for other similar purposes.

Injunctions may also be classified as preliminary or final. The primary purpose of the former type, which is also sometimes called temporary or interlocutory, is to prevent threatened wrongs and to preserve the status quo until the holding of a final hearing. Notice to the respondent and a preliminary hearing are usually required before a preliminary injunction will be granted. The question of granting or refusing such an injunction is left to the sound discretion of the court and depends upon whether the complainant can show an urgent necessity for relief prior to the thorough investigation of the case. A bond or other security is frequently required in connection with obtaining such an injunction. The issuance or the withholding of a preliminary injunction, not being a final order, is ordinarily not

reviewable by a higher court. Closely related to a preliminary injunction is a temporary restraining order, the purpose of which is also to preserve the status quo. This type of order requires the respondent to appear on a certain day and to show cause why a temporary injunction should not be issued. A final or permanent injunction is issued after the hearing of a case on the merits, and the granting or refusal of such an injunction is a reviewable order.

Another type is the ancillary injunction, an order issued by a court either to protect its own jurisdiction and to make its judgment effective or to aid proceedings in another court.

Issuance.—Injunctions are ordinarily issued by courts of equity rather than by tribunals possessing strictly common-law jurisdiction. In most cases the court must be satisfied that a suit for damages or any other ordinary legal action would be inadequate. This does not mean that there must be a total lack of legal remedy in order for a complainant to invoke equity jurisdiction. In an appropriate case, an injunction may be granted where a remedy at law exists, but is not sufficiently complete or prompt to effect substantial justice.

The remedy at law is considered to be inadequate, so as to justify the grant of an injunction, where the injury is irreparable or where a multiplicity of suits would be necessary in order to redress the wrong. On the other hand, if the injured party can obtain full relief through a single action at law for damages or through some other single lawsuit, an injunction will be refused on the ground that the remedy at law is adequate. Irreparable injury is a technical term which is not construed in its literal sense. It may mean that complete compensation for the wrong in question cannot be made by the payment of damages or, alternatively, that the amount of damages is difficult or impossible to measure. The term may also refer to the fact that the injury is continuous or repeated or that the wrongdoer is unable to pay damages because of insolvency.

The term "multiplicity of suits" may refer either to the number of actions which the injured party would have to bring in order to obtain complete redress by way of damages or to the possibility that the person seeking the injunction might himself be repeatedly harassed by lawsuits. Examples of circumstances under which courts of equity will grant injunctions because the complainant would have to bring a succession of lawsuits to obtain sufficient relief are cases of nuisance, waste, trespass to land, and disputed boundaries, in which the wrong complained of is by nature continuous or repeated. An example of vexatious actions against a complainant in an injunction suit is the situation where he has been subjected to a series of actions of ejectment to recover the same tract of land. In such a case, equity will interfere and grant an injunction prohibiting further lawsuits, provided that the complainant's legal title to the land has been clearly established. Similarly a court may issue an injunction to prevent repeated attempts to enforce the collection of invalid taxes.

Property Rights.—Traditionally the rights which equity will protect by injunction are property rights. The protection afforded extends to property both real and personal, both tangible and intangible. The remedy is frequently resorted to for the prevention of such torts as recurring trespasses, nuisances, and injuries resulting from

the pollution, obstruction, or diversion of waters. Injunctions will not usually be granted for recovery of possession of real or personal property, inasmuch as conventional legal remedies, such as ejectment or replevin, are adequate. For the same reason the invasion of personal rights, as distinguished from property rights, will not generally be enjoined. The tendency of modern courts, however, is to extend the definition of property rights to include all rights of a pecuniary nature. Similarly some statutes expressly authorizing the injunctive protection of personal rights have been enacted. Political rights will not, as a rule, be protected by injunction, and the courts will not enjoin acts which are solely criminal and do not affect property rights.

Contracts.—Injunctions are often granted to prevent breaches of contract. For example, a person may be restrained from accepting a new employment where the services which he has contracted to perform for his present employer are unique or extraordinary, as in the case of writers, entertainers, and professional athletes. Contractual restrictions on entrance into a competing business or professional practice are also enforceable by injunction.

Equity.—The grant or denial of an injunction is governed by general equitable principles and is largely dependent upon the sound discretion of the court. As in the case of other remedies, a court will not issue an injunction which it lacks the power to enforce. No jury trial is provided, and in most cases there is no absolute right to an injunction. It will not be issued if the complainant has been guilty of misconduct, fraud, or unfairness in connection with the subject matter of the injunction suit, nor will it be granted at the request of a person guilty of unreasonable delay operating to the disadvantage of the other party. For example, if a complainant seeking an injunction to compel the removal of buildings encroaching upon his land had allowed a long period of time to pass and had allowed the respondent to make large expenditures for the erection of the buildings without attempting to stop him, a court would probably refuse his request for an injunction. This sort of defense to an injunction suit is known as laches, or acquiescence. Lapse of time alone does not constitute the defense, since it must be shown that the complainant had actual knowledge or adequate means of knowledge in order for the delay to be held unreasonable. Similarly, if the delay is excusable, such as might be caused by the respondent's promises to remedy the wrong, the doctrine of laches does not apply.

In order to obtain an injunction a complainant must show a clear right or title which he seeks to protect, since the question of title and other rights in property will not ordinarily be tried in an injunction proceeding. The complainant must demonstrate the existence or the real threat of substantial injury to his rights, as a court of equity will not interfere, if the suit is based upon a mere possibility or apprehension of harm or if the injury threatened is trivial. Injunctions will not be granted to prevent the doing of lawful acts, such as conducting a legitimate business, disposing of one's property as one chooses, or enforcing a debt, though others may be incidentally harmed.

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RICHARD L. HIRSHBERG.

INJURIES, Industrial. See ACCIDENTS, CAUSES AND PREVENTION OF.

INJURY, in law, an act by which the rights of another person or of the state are violated and for which the party whose rights are so invaded may institute action for damages against the perpetrator. Wrongs called *damna absque injuria* are those acts which while injuring another do not permit the latter the right to enter an action, there being no remedy for such acts. See also CRIME; CRIMINAL LAW; LIABILITY INSURANCE; TORT.

INK, a colored liquid used for writing; also a liquid or paste used for printing. Of the many varieties of ink the oldest known is India or China ink which is thought to have been used in China as early as 1200 B.C. Usually marketed in dry cakes or sticks, India ink is made of lamp-black or ivory black mixed with glue or a gum. Its rich blackness and permanence are distinctive qualities. Sepia, extracted from the squid, octopus or cuttlefish, was used as an ink in ancient times. Nutgall ink, made of nutgalls and copperas (green vitriol), seems to have been known as early as the 2d century A.D. It is essentially the standard black ink of commerce today; however, the tannic acid constituent is now generally supplied by some other substance than nutgalls.

The following are some of the more important kinds of inks:

Aniline.—An aniline dye solution in a volatile solvent or dilute gum, used for printing in bright colors, or at high speeds.

Cancelling.—Suspension of lampblack in oil, used for stamp pads.

Copying.—An iron-tannic acid ink.

Diamond.—Mixture of barium sulfate and hydrofluoric acid used for writing on glass.

Fugitive.—When treated with water, or bleaching chemicals, it disappears; used for printing bank checks.

Invisible, Secret, or Sympathetic.—Normally invisible, such inks (there are many varieties) become visible when the writing is exposed to heat, light, water, or particular chemicals.

Printing.—There are three types: (1) pigment suspension in a mineral oil, or in a drying oil; (2) aniline; and (3) a warm molten resinous pigment for high-speed printing.

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INK DRAWING. See ART DRAWING.

INKBERRY or WINTERBERRY, an evergreen shrub (*Ilex glabra*) of the holly family native to the Atlantic coast from Massachusetts to Florida, also to Alabama and Mississippi. Its slender and flexible stems are two to four feet high and its leaves, about an inch in length, are lanceolate, of leathery texture, and present a shining upper surface. It bears small, very black berries which are valued for decoration. Formerly its bark and leaves were used medicinally, especially for fevers.

INKERMAN, ینگ'کەر-مان, village, USSR, on the site of a ruined town in the Crimea, at the head of the harbor of Sebastopol, at the

mouth of the Chernaya River. It gives its name to the sanguinary battle fought on the heights overlooking the town, on Nov. 5, 1854, when the Russians unexpectedly attacking the British camp were repulsed with great slaughter on both sides. In World War II it was captured by the Germans on June 28, 1942.

INLAYING is the art of producing an ornamental surface by inserting varicolored forms and substances and reducing the whole to a smooth uniform condition, but with a pattern formed by the contrasting material introduced. Its essential difference from mosaic work is that mosaic (q.v.) is mainly made up of very small surfaces, while inlaid work is additional to a surface, as of ivory on wood, already existing, to add to its beauty. Various kinds of metal or wood, or pearl and ivory, are employed in this process, which is now applied chiefly to the production of ornamental articles of furniture. When wood of one color is inlaid with others of different colors, as in ornamental devices in flooring, it is generally called parquetry, the various pieces of wood being usually disposed in regular geometrical figures. Marquetry is simply the French term for inlaying. The art of inlaying iron or steel with other metals, as gold or silver, is called damascening. Boulle (or buhl) and riesener work, once highly prized, have lost much of their celebrity. The former is named from Charles André Boulle, an Italian cabinetmaker to Louis XIV, and the latter from Jean Henri Riesener, a Franco-German cabinetmaker to Louis XVI. Boulle for the most part inlaid brass on tortoiseshell, Riesener a dark wood on a tulip-wood ground. The usual instrument for cutting out veneers for inlaying is a fine saw, mounted in a bow or arched handle, and worked in short quick movements. Three or four veneers are sometimes cut simultaneously in this way. Inlaying with stone, a Florentine specialty, is called *pietra dura*, and differs from mosaic in having the holes not cut through the ground, which is commonly of black marble, but only to a regulated depth.

INMAN, Henry, American artist: b. Utica, N. Y., Oct. 28, 1801; d. New York, N. Y., Jan. 17, 1846. From early boyhood he manifested a taste for art, and in 1814 John W. Jarvis, the portrait painter, offered to receive him as a pupil, and he was bound an apprentice for seven years. After completing his apprenticeship he devoted himself to portrait painting. In 1832 he married and settled at Mount Holly, near Philadelphia. He was a founder of the National Academy of Design and one of its vice-presidents. Among his most characteristic portraits are those of Chief Justice John Marshall, Marquis de Lafayette, William Penn, Martin Van Buren, Fitz-Greene Halleck, John J. Audubon, DeWitt Clinton, Clara Barton, and Bishop William White. Many of his portraits are in public buildings in New York, Albany, and Philadelphia. He also painted landscape and genre scenes. His portrait of the poet William Wordsworth, made while he was in England in 1844-1845 and now at the University of Pennsylvania, is one of his best known.

INN, a river of Europe which issues from a lake at the foot of the Piz Longhino in the Rhaetian Alps, at an altitude of about 8,000 feet, forms a series of small lakes, the best known of which is that of Saint Moritz, then flows

northeast through the deep, narrow Engadine valley in the Swiss canton of Graubünden (Grisons). It enters Austria at Finstermünz Pass in the Tirol, passes Innsbruck, Solbad Hall, and Kufstein, and flows into Germany through the Bavarian Alps. At Mühldorf it turns east and finally empties into the Danube at Passau. Running a course of over 300 miles, it drains an area of approximately 10,000 square miles. Because of its rapid current, it is of little importance as a navigable river, but it is used to bring timber down to the Danube from the forests of its upper regions. There are many hydroelectric plants on its upper course, and agriculture is extensive in the more fertile lower valley. It forms the border between Germany and Austria from its confluence with the Salzach, its most important tributary, to Passau.

INN, a public house for the commercial lodging of travelers. Inns have existed since Biblical and Roman times, when a bush attached to a roadside stake was the sign of an inn. Following a decline during the barbarian invasions, the demand for inns grew with the increase in travel consequent on pilgrimages, crusades, and expanding trade, and by the 14th century more distinctive inn signs had appeared. A prominent feature of most inns in coaching days was the courtyard, where passengers were discharged. The large room of the market town inn served as an assembly hall. With the advent of the railroad, roadside inns declined, but they have revived with automobile travel in the 20th century.

Early innkeeping standards were crude, but as travel and competition developed, facilities improved, and minimum standards were established by government regulation. The luxurious modern hotels and motels are developments of the original inn, which now exists for the most part only in country districts. See also **HOTELS**.

RICHARD E. WEBB.

INNATE IDEAS, *in'nāt*, ideas with which a person is born or, less strictly, which are at least not learned, abstracted, or compiled from sense perception. Many theologians, philosophers, and psychologists have thought that such ideas exist and are the bases of religion, morality, mathematics, logic, or common sense. The term "innate ideas" is thus used both for bare concepts (such as God, justice, number, or physical objects) and for a grasp of truth about the corresponding objects (such as the existence of God, the laws of justice or number, and so forth). Innate ideas are supposed to be peculiarly (1) universal, in that they both apply very generally and are accepted very widely; (2) certain, in that the mind cannot doubt them and that they are in fact infallible; and (3) necessary, in that they could not be otherwise and that rational life would be impossible without them. Though they are especially intimate traits or acts of the individual spirit, they are supposed nevertheless to plumb most deeply and truly the nature of things in themselves.

Plato (427?-347 B.C.), probably influenced by the Pythagorean belief in reincarnation, gave an early and charming account of innate ideas. To explain how even the untutored can appreciate proofs about ideal geometrical objects never met in experience, he conjectured that every soul brings into this life a memory of a previous contemplation of the pure forms on which

mundane things are modeled (these forms are "ideas" in the special Platonic sense), and that diagrams or argument only recall this knowledge to us. His similar suggestions about the evocative power of beauty are echoed by some modern poets such as Percy Bysshe Shelley and William Wordsworth.

Many ancient thinkers, independently of Plato, distinguished some fundamental ideas and beliefs as especially natural and common, and Cicero (106-43 B.C.) called these "innate." Christianity taught that there is a kind of natural revelation of principles essential to human existence—religious, moral, metaphysical, and logical—which God imparts to all peoples. At the Renaissance, this seemed at first rather confirmed by new anthropological discoveries, while great scientific successes both in pure mathematics and in celestial and terrestrial mechanics encouraged the notion of a "natural light" which needs only maturity and opportunity to divine the truth. René Descartes (1596-1650) may have meant by "innate ideas" no more than this faculty of reason. However, the monadism of Gottfried Wilhelm von Leibniz (1646-1716) described all knowledge as a becoming explicit of what was always implicit in the learner's essence. More religious writers, particularly the Cambridge Platonists in England such as Henry More (1614-1687), revived a trust in literal innateness.

There resulted an extreme empiricist reaction. John Locke (1632-1704) and later Voltaire (1694-1778), drawing on a better informed anthropology and on common sense, easily made fun of any pretense that babies and savages are acquainted with such esoteric principles as Platonism boasted. They returned to the maxim, no less ancient, that the mind starts as a blank tablet (*tabula rasa*) on which experience does the writing. Scholasticism had long had the maxim, not always strictly observed, "There is nothing in the intellect which has not been in the senses," and David Hume (1711-1776) repeated that all ideas are derived from impressions. When such empiricism admitted a priori truth at all, it meant not that its content is conceived independently of experience but only that, once conceived, its necessity is evident without perceptual induction or sampling. Empiricism, or sensationalism as it is called in the extreme version of Étienne de Condillac (1715-1780), largely prevailed among philosophers and scientists in England and France.

It was evident, however, despite Condillac's description of how a statue might be educated by experience, that experience in fact teaches nothing to statues, but only to beings with a certain innate organization. Thomas Reid (1710-1796) and other Scottish realists restored an emphasis on universal deliverances of common sense which verged on innatism. Even George Berkeley (1685-1753), generally an empiricist in denying that any ideas are strictly innate, had believed in "notions" which are autonomous acts of mind and yet penetrate to reality as mere "ideas" do not. Later, idealism was widely successful with the Kantian (Immanuel Kant, 1724-1804) and post-Kantian doctrine that the structure if not the content of experience is due to a transcendental power of the mind. "Nativism" in late 19th century psychology stressed that not even sense perception would be possible without some inborn principles by which it is ordered, and the evolutionism of Herbert Spencer (1820-1903) and Charles Peirce (1839-1914) argued that living

things must inherit more or less salutary habits of conception and belief from fortunate ancestors, so that ideas, like instincts, have a certain innateness in the individual though acquired in the race. The dispute, therefore, without being settled, lost vigor, and was absorbed in such general questions as the philosophical problem of a priori knowledge and the biological one of the relative roles of environment and heredity. See also *IDEA*.

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INNER MONGOLIA, in'ēr mōn[g]-gōl'yá, officially now called the INNER MONGOLIAN AUTONOMOUS REGION (IMAR), an administrative unit of the People's Republic of China, founded on May 1, 1947. It includes large portions of the traditional Inner Mongolian provinces of Chahar, Suiyuan, Ninghsia, Jehol, and part of Kansu, north of the Great Wall, and also (since January 1948), the Barga area of western Manchuria. Kùke Khoto (Kuei-hua) serves as capital of the region, and the dominant political figure has for many years been the Communist, Ulanfu (Yun-tse, b. 1905). In the Ordos region, formed by the great bend of the Yellow River, extensive industrial expansion attends the contemporary development of the city of Paotow as a major steel-producing center of China. Also in the Ordos, Ejen Khoro is famed as the site of the purported remains of Genghis Khan (q.v.). The 1953 census of China reports 1,462,956 Mongols (most, but not all, of whom live in the IMAR), and a total IMAR population of 6,100,104. Chinese farmers constitute the main non-Mongol element of the population. See also *MONGOLIA*.

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INNER RHODES or **INNERRHODEN**.
See *APPENZELL*.

INNESS, in'ēs, **George**, American painter: b. near Newburgh, N.Y., May 1, 1825; d. Bridge of Allan, Scotland, Aug. 3, 1894. The son of a prosperous merchant, he spent his boyhood in Newark, N.J. At the age of 16 he was employed by an engraving firm in New York City, but left the company after a year to devote all his time to painting. He exhibited at the National Academy of Design in 1844 and soon opened his own studio; he had had a few drawing lessons but was practically self-taught. Though his work of this period was rather stiff, it showed his talent for depicting landscapes, in which he specialized. In 1847 he went to paint in Italy for a year, returning there with his wife in 1851 for a longer period; in 1854 they went to Paris, where he was profoundly influenced by the work of painters of the Barbizon school. (See *BARBIZON, THE PAINTERS OF*.) After they returned to the United States, they lived in Medfield, Mass., where Inness painted some of his best-known pictures, and eventually settled in Montclair, N.J. He was elected to the National Academy in 1868, but for many years his paintings sold poorly. About 1875, however, the interest of Thomas B. Clarke and other rich collectors established a vogue for his work, and he enjoyed fame and financial success thereafter. He died while traveling in Scotland.

His early works, which are somewhat literal and quite detailed, show the characteristics of the Hudson River school. A typical example from this period is *Peace and Plenty* (The Metropolitan Museum of Art, New York City). In time he developed a freer, more individual style, and a calm lyrical quality replaced his earlier dramatic romanticism. Among his better-known canvases are *Georgia Pines*; *September Afternoon* (National Gallery of Art, Washington, D.C.); *Autumn Oaks*; *Spring Blossoms* (The Metropolitan Museum of Art); *Home of the Heron*; and *Millpond* (Art Institute of Chicago).

Consult Inness, George, Jr., *The Life, Art, and Letters of George Inness* (New York 1917); McCausland, Elizabeth, *George Inness, an American Landscape Painter* (New York 1946).

INNESS, George, Jr., American painter: b. Paris, France, Jan. 5, 1854; d. Cragmoor, N.Y., July 27, 1926. The son of the famous American landscape artist George Inness (q.v.), he began to study with his father about 1870 and worked with him in Rome until 1874. He then went to Paris where he studied with Léon Bonnat. After his return to the United States, he shared a studio with his father, but maintained one of his own in Paris from 1895 to 1899. He exhibited every year at the Paris Salon, receiving honorable mention in 1896 and a gold medal in 1900. Elected to the American National Academy in 1899, he was made an officer of the French Académie des Beaux Arts in 1902. He was well known for his animal pictures and also for landscapes in a style similar to his father's later works. Two of his best-known paintings, *The First Snow at Cragmoor* and *Shepherd and Sheep*, are in The Metropolitan Museum of Art in New York City.

INNOCENT, in'ō-sēnt, the name of 13 popes, as follows:

INNOCENT I, SAINT: b. Albano, Italy; d. March 12, 417; r. 401-417. As successor of Anastasius I, he became pope in 401, and although little is known of him personally, the record of his actions in ecclesiastical affairs for 16 years shows him to have been capable, vigorous, and energetic. He advised the bishop of Rouen, St. Victricius, that questions of importance should always be referred to the Holy See, and he sent the same instructions to the bishops of Spain and Africa. An advocate and exponent of clerical celibacy, he is most famous for the support he gave to St. John Chrysostom in his difficulties at Constantinople. Innocent's approval of the acts of the councils of Carthage and Milevis (416) was announced to the people of Hippo by St. Augustine in terms which gave rise to the adage *Roma locuta, causa finita est* (Rome has spoken, the case is closed). During his reign the barbarians crossed the Rhine (Dec. 31, 406), and the Goths sacked Rome (410). His feast is observed on July 28.

INNOCENT II (GREGORIO PAPARESCI): b. Rome; d. there, Sept. 24, 1143; r. 1130-1143. His ecclesiastical career began about 1080, and he was made a cardinal in 1116 by Paschal II. He served in the Curia under Gelasius II, Calixtus II, and Honorius II. After the death of Honorius in 1130, Innocent was elected pope by a group of the cardinals; but the ceremonies were not yet completed when another and larger group of them elected Pietro Pierleone, who took the name of Anacletus II. The question of the legality of

these elections is one of the most interesting and thorny problems in papal history. The possession of the Roman See was in dispute between the two rival popes until 1138, when Pierleone's death ended the schism; in the following year Innocent called the Second Lateran Council to repair the damage it had caused. (See *LATERAN COUNCILS*.) Apart from these difficulties, he devoted himself to effecting a moral reformation, condemning dogmatic errors, and settling conflicts on relations between church and state. He is remembered for his condemnation of Abelard and of Arnold of Brescia as heretics.

INNOCENT III (LOTARIO DE' CONTI): b. Anagni, Italy, 1160 or 1161; d. Perugia, July 16, 1216; r. 1198–1216. Educated at Paris and Bologna, he went to Rome about 1185, took minor orders, and was made a canon of St. Peter's. He was ordained subdeacon in 1187, and made cardinal deacon of Saints Sergius and Bacchus under Clement III. On the very day of Celestine III's death (Jan. 8, 1198), Innocent was elected to succeed him. He considered the medieval Christian world to be essentially one community in which the spiritual authority should, by right, dominate the temporal. This policy led to a multiplicity of conflicts with the sovereigns of the day and to an overgenerous application of ecclesiastical censures. As a result, spiritual penalties, by undue familiarity, lost much of their terror. At various times he deposed, excommunicated, or interdicted almost every king in Christendom.

His greatest political victory occurred in consequence of a dispute over the election of the archbishop of Canterbury. When King John of England opposed the nominee of the Holy See, Innocent placed England under interdict (1208), excommunicated John, and finally in 1212 deposed him. Threatened with invasion by King Philip II of France, John capitulated to the pope and in 1213 made the crown of England vassal to the Holy See. When, in 1215, the barons forced John to sign Magna Carta, Innocent declared the document null and void, on the ground that it had been extorted from his vassal by violence.

Strong as a protector of the faith, he launched (1202) the Fourth Crusade, which resulted in the temporary union of the Greek and Roman churches, and sent an army (1208) against the Albigensian heretics when they failed to yield to persuasion. (See *CRUSADES—Fourth Crusade; ALBIGENSES*.) In 1215 he convened the fourth and most important of the Lateran Councils (q.v.), at which numerous doctrinal issues were settled and another crusade proclaimed. In the inner government of the church he made significant reforms and fostered the initial rise of the Franciscan and Dominican orders. Innocent's tireless activity, full consciousness of his rights and duties, and enormous but disinterested ambition raised the high medieval concept of the papal monarchy to its zenith during his reign.

INNOCENT IV (SINIBALDO DE' FIESCHI): b. Genoa, Italy, c. 1190; d. Naples, Dec. 7, 1254; r. 1243–1254. Educated at Bologna, he became one of the most celebrated canonists of his day. Gregory IX made him a cardinal in 1227, and vice chancellor of the church at Rome in 1228. After the papal chair had been vacant for a year and a half, he was elected pope in succession to Celestine IV on June 24, 1243. He was a follower of the political policies of Innocent III, and his reign was a continual contest between himself and Frederick II, the Holy Roman emperor.

Obligated to flee from Rome to Lyon, Innocent directed a war against Frederick. The latter was defeated by papal troops at Parma in 1247, but his hold on northern Italy was so strong that the pope could not return to Rome until after Frederick's death in 1250. He blessed the crusade undertaken by Louis IX of France in 1248, encouraged missions in various parts of the world, and aided such universities as the Sorbonne in Paris. His *Apparatus in quinque libros decretalium*, first printed at Strasbourg in 1477, provides an excellent commentary on the decrees of Pope Gregory IX and was long considered a classic in canonical literature.

INNOCENT V, BLESSED (PIERRE DE TARENTAISE): b. Tarentaise, Savoy, France, c. 1225; d. Rome, June 22, 1276; r. Jan. 21–June 22, 1276. Having entered the Dominican Order at an early age, he studied theology at the University of Paris, where he took a doctor's degree and became a professor in 1259. That same year he was associated with Thomas Aquinas, Albertus Magnus, and 10 other members of the order in drawing up a curriculum of study which still remains the basis of Dominican teaching. He produced various works on theology and philosophy, including his highly esteemed commentaries on the *Sentences* of Peter Lombard. In 1272 he was appointed archbishop of Lyon and the following year became cardinal bishop of Ostia. An adviser to Pope Gregory X, he took a prominent part in the general council held at Lyon in 1274. He was unanimously chosen to succeed Gregory X on Jan. 21, 1276, but died after only five months as pope. During his short pontificate he promoted peace among the warring Italian states and worked to cement the union of the Byzantine Church with the Latin Patriarchate which had been arranged at the Council of Lyon. His cult as a beatus was confirmed by Pope Leo XIII in 1898, and he is described in the Roman Martyrology as one who "strove for concord among Christians."

INNOCENT VI (ÉTIENNE AUBERT): b. Monts (in present Corrèze Department), France; d. Avignon, Sept. 12, 1362; r. 1352–1362. First a professor of civil law at Toulouse, he became bishop of Noyon (1338), bishop of Clermont (1340), and a cardinal (1342). In 1352 he was made cardinal bishop of Ostia and Velletri and was named Grand Penitentiary. Later that year when The College of Cardinals met at Avignon to elect a pope to succeed Clement VI, they agreed that the one who was elected would share his powers with the college. Proclaimed pope on December 18, Innocent soon annulled the agreement.

He required the higher clergy to observe the laws of residence in their sees and urged members of religious orders to adhere to their rules of monastic discipline. He became involved in a lengthy dispute with Pedro of Castile, who wished to put aside his wife, Blanche de Bourbon, whom the pope sustained in the litigation. Innocent approved the coronation in 1355 of Charles IV as Holy Roman emperor, but the following year Charles issued the famous *Bulla Aurea* (see *GOLDEN BULL*), in which he attempted to annul the right of popes to confirm the election of rulers of the Holy Roman Empire. Innocent ignored this feature of the bull. He founded the Collège de St. Martial at Toulouse (1359) and a theological faculty at Bologna (1360). Though his reign was not free from nepotism, he was one

of the few reformists of his time and is considered one of the best of the Avignon popes.

INNOCENT VII (COSIMO DE' MIGLIORATI): b. Sulmona, Italy, c. 1336; d. Rome, Nov. 6, 1406; r. 1404-1406. Named archbishop of Ravenna (1387) and bishop of Bologna (1389), he became a cardinal on Dec. 18, 1389, and the following year Boniface IX sent him as papal legate to Lombardy and Tuscany. He was elected to succeed Boniface in 1404, but as this took place during the Western Schism, his claims to the papacy were opposed by Benedict XIII of Avignon. In an uprising in Rome his nephew Ludovico de' Migliorati, whom he had made a cardinal, murdered a group of the Roman leaders, and the anger of the people forced the pope to flee to Viterbo in 1405. When the Romans realized that he was not responsible for his nephew's crime, they again submitted to his authority, and he returned to Rome in 1406. He is remembered chiefly for his restoration of the University of Rome.

INNOCENT VIII (GIOVANNI BATTISTA CIBO): b. Genoa, Italy, 1432; d. Rome, July 26, 1492; r. 1484-1492. After studying at Bologna and Rome, he was made bishop of Savona (1467), bishop of Molfetta (1472), and a cardinal (1473). On the death of Sixtus IV, he was elected pope in 1484. In 1486 he acknowledged Henry VII as the true king of England by right of conquest, inheritance, and national choice. The following year he appointed Tomas de Torquemada grand inquisitor of Spain. Failing to unite Christendom in a crusade to halt the Turks in Europe, he succeeded in gaining custody of Prince Jem (or Djem), the brother of Bajazet II, sultan of the Ottoman Empire. By threatening to support Jem's claim to the Ottoman throne, he brought Bajazet to terms in 1489. During his pontificate the Moorish kingdom of Granada was conquered, as a result of which the pope granted to Ferdinand of Aragon and Isabella of Castile the title of *los reyes católicos*, literally "Catholic kings."

Under his government Rome and the States of the Church fell into a condition in which robbery and violence occurred daily. Though personally affable and generous, Innocent lacked the finer shades of moral discrimination, and an important aspect of his reign was the secularization of the sacred college, to which he promoted for political and personal reasons many unworthy men. This was a great barrier to the reform of the church from within before Martin Luther.

INNOCENT IX (GIOVANNI ANTONIO FACCHINETTI): b. Bologna, Italy, July 20, 1519; d. Rome, Dec. 30, 1591; r. Oct. 29-Dec. 30, 1591. He studied at Bologna and was made bishop of Nicastro in Calabria by Pius IV in 1560. In 1652 he took part in the Council of Trent. Sent as nuncio to Venice in 1566, he helped to arrange the alliance of the pope with Venice and Spain which resulted in the victory over the Turks at Lepanto in 1571. About 1572 he returned to Rome and was made a cardinal in 1583. During the illness of Gregory XIV he conducted papal affairs, and on that pontiff's death (1591) he was elected his successor. Although he wrote prolifically, his works remain in manuscript.

INNOCENT X (GIOVANNI BATTISTA PAMFILI): b. Rome, May 6, 1574; d. there, Jan. 7, 1655; r. 1644-1655. He studied law in Rome, and in 1604 became attached to the Roman Rota. After serving as nuncio to Naples (1621-1625) and to Spain (1626), he was created cardinal in 1627 but was not proclaimed as such until 1629. He

succeeded Urban VIII as pope in 1644, and his election meant a shift of papal favor from France to Spain. He confiscated the property of Antonio and Francesco Barberini (protégés of the French cardinal, Jules Mazarin), favored the Spanish clergy, and refused to recognize Portugal's independence from Spain. In the conduct of papal affairs he depended for guidance on his sister-in-law Donna Olimpia Maidalchini whose greed, ambition, and intrigues made her extremely unpopular. He condemned Jansenism (q.v.) in his bull, *Cum occasione*, in 1653. Although he led a life of piety and was personally amiable, his diffidence and indecisiveness made his reign an unfortunate one.

INNOCENT XI, BLESSED (BENEDETTO ODESCALCHI): b. Como, Italy, May 16 or 19, 1611; d. Rome, Aug. 12, 1689; r. 1676-1689. Educated by the Jesuits at Como and in jurisprudence at Rome and Naples, he became a protonotary apostolic and president of the Camera Apostolica after entering the curial service. He was made a cardinal in 1645 and was legate at Ferrara (1645-1650) and bishop of Novara (1650-1654). Esteemed for his piety and desire for reform, he was elected to succeed Clement X in 1676, despite French opposition. He came into sharp conflict with Louis XIV over the selection of bishops in France and other aspects of Gallicanism (q.v.), and Louis threatened to separate the French church from Rome. In his civil administration, Innocent strove against nepotism, abolished sinecures, closed gaming houses, and enforced measures of economy.

In ecclesiastical affairs he recalled religious orders to strict observance of their rules, and was exacting in approving candidates for the episcopate. He attempted to revive the custom of frequent communion, but Jansenist opposition postponed this until the time of Pius X (r. 1903-1914). Although Innocent had been accused of favoring quietism (q.v.), Miguel de Molinos and Pier Matteo Petrucci were condemned during his time for teaching heresy. The process of his canonization was initiated in 1692, but after some preliminary steps in 1714 and 1736 it remained in abeyance until Pius XII beatified Innocent in 1956.

INNOCENT XII (ANTONIO PIGNATELLI): b. near Spinazzola, Italy, March 13, 1615; d. Rome, Sept. 27, 1700; r. 1691-1700. He studied at Rome and was made a prelate by Urban VIII. Having served as vice legate at Urbino, as governor of Viterbo, and as nuncio at Florence, to Poland, and at Vienna, he was made a cardinal in 1681 and became archbishop of Naples in 1687. He was elected pope to succeed Alexander VIII in 1691. Innocent prohibited nepotism in the bull *Romanum decet pontificem* (1692) and was an advocate of economy in administration; his various reforms included forbidding judges to receive gifts from parties at litigation. He ended the long quarrel between Louis XIV and Rome, and received from Louis and the French bishops a retraction of the Declaration of Gallican Liberties (see GALLICANISM). However, his reign was much disturbed by doctrinal disputes such as the question of Jansenism, which he condemned. The mystical teachings of Mme. Guyon and her disciple Fénelon (François de Salignac de la Mothe-Fénelon), which resembled quietism (q.v.), led to a lengthy dispute between Celestino Sfondrati and Jacques Bénigne Bossuet. Innocent decided against Fénelon, condemning many of his beliefs, but refused to condemn Sfondrati's book on predestination.

INNOCENT XIII (MICHELANGELO CONTI): b. Rome, May 13, 1655; d. there, March 7, 1724; r. 1721-1724. Having served as nuncio in Switzerland and in Portugal, he was made a cardinal in 1706 and later became bishop of Osimo and of Viterbo. Soon after he was elected pope (1721) in succession to Clement XI, he invested Charles VI of the Holy Roman Empire with Naples. Hoping for a restoration of Roman Catholicism in England, he supported James Francis Edward Stuart (q.v.), the "Old Pretender," in his claim to the throne. He showed disfavor to the Jesuits and forbade them to receive novices in China, where they were accused of allowing the retention of certain Chinese rites. It was for a time feared by the adversaries of the Jansenists that Innocent would repeal the bull *Unigenitus* (1713) because he had, while a cardinal, spoken against its publication. However, as pope, he required its acceptance.

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INNOCENTS ABROAD, *The*, in'ô-sents à-brôd', in full *The Innocents Abroad, or The New Pilgrim's Progress, Being Some Account of the Steamship Quaker City's Pleasure Excursion to Europe and the Holy Land*, first of the major works of Mark Twain (Samuel Langhorne Clemens, q.v.), published in July 1869. Early in 1867, the author was in New York City as special correspondent for the *Alta California*, a San Francisco newspaper. Seeing the announcement of an excursion to the Mediterranean in a chartered steamer, he persuaded his employers to send him along. The resulting 50-odd letters of travel, written between June and November 1867, were the basis for the book. About half the work, including most of the second part, was taken from the newspaper with only minor revision; the rest was rewritten and expanded. Issued by the American Publishing Company of Hartford, Conn., a subscription house, the book sold about 100,000 copies in its first three years and, in its author's words, "went right on selling, just like the Bible."

When Mark Twain took the trip, he was 31 years old, had never been out of the United States, and, except for New Orleans, New York, and Philadelphia, had never seen a city more than 50 years old. Overseas he alternated between reverence and ridicule. Thus he was awe-struck at what the worn pavements of Pompeii revealed of the continuity of human life, but he mocked the old masters and fraudulent relics his fellow tourists gushed over, because he suspected the emotion was insincere. In the Holy Land, similarly, he described the squalor he saw, which the devout tended to overlook in their piety. As a result, some earnest people thought the book blasphemous.

Although, like most of Mark Twain's works, the *Innocents* is uneven, it contains enough of the perennial comedy of guileless tourism to be entertaining still.

DELANCEY FERGUSON.

INNS OF COURT, inz, kôrt, four legal societies in London which control admission to the English bar. Their names—Lincoln's Inn, the Middle Temple, the Inner Temple, and Gray's Inn—are derived from the buildings they occupy near the Royal Courts of Justice. Founded in the 13th century, the Inns of Court were successors to the London law schools which Henry III suppressed in 1234. Restrictions which prevented the clergy from teaching civil law and from appearing as advocates in civil courts had opened the legal profession to poorly qualified practitioners; to remedy this situation, Edward I in the late 13th century delegated the responsibility of training and licensing legal practitioners to groups which later became the Inns of Court. Their establishment represents the triumph of the common law and its severance from canon law and classical learning.

The societies were originally groups of students who resided at the various inns, where they studied law as apprentices to eminent legal personalities. In the 17th century they fell into decay, but the establishment in 1853 of the Council of Legal Education and the formation in 1894 of the General Council of the Bar restored their position. No longer residential, they have become centers of the profession and of legal education in England. Through their joint council they give lectures for students, hold examinations, and have a monopoly on the privilege of "calling to the bar" or conferring the rank of barrister. Law students must ordinarily spend a minimum probationary period of three years' study at one of the Inns before being called to the bar. Each of the societies disciplines its own members and in extreme circumstances may deprive a member of the right to practice. Each has its own governing body whose members are known as benchers; ordinary barristers and students make up the remaining membership. Prominent persons may be appointed honorary benchers of any of the Inns of Court, and the royal family usually has members on the benches of all four. The Inns of Chancery, lesser institutions where students prepared for the Inns of Court, ceased to function in the 19th century. See also BARRISTER.

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INNSBRUCK, inz'bröök, Ger. ins'bröök, city, Austria, capital of the Province of Tirol, located in the eastern Alps at an altitude of 1,883 feet, on the Inn River at its junction with the Sill, about 60 miles south of Munich, Germany. Famous for the beauty of its rugged mountain scenery, the site of Innsbruck has commercial and strategic importance as well, since it is at the point where the route connecting western Europe with the Danubian plains crosses the easiest route from Germany to Italy via the Brenner Pass. A railroad and market center, it has little industrial importance, but there are food processing plants, a hydroelectric plant, and some textile mills. Since it offers mountain climbing in the summer and skiing and other sports in the winter, it is a year-round resort, and tourism is an important source of income.

The older part of the city is around the bridge across the Inn. The many imposing buildings here include the Fürstenburg, a 15th century castle noted for its Goldene Dachl (a balcony with a gilded roof) and the Hofkirche, or court church, which contains the monumental cenotaph of Emperor Maximilian I. St. Anne's Column, the Ferdinandeum Museum, the Museum of Tyrolean Folk Arts, and the botanical gardens are other points of interest. The university (founded in 1677) is the center of cultural activities.

There have been settlements on this site since prehistoric times, and there was a Roman station on the site of the modern suburb of Wilten. Innsbruck was fortified in 1233 and became the capital of the Tirol in 1420. The residence of a branch of the Habsburg family from 1363 to 1665, it was the center of the revolt of Tyrolean peasants in 1809. Pop. (1951) 95,055.

INO, ī'nō, in Greek mythology, the daughter of Cadmus and second wife of Athamas, a legendary king of Boeotia. See **ATHAMAS**.

INOCULATION. See **VACCINES AND VACCINATION**.

INONU, ē-nū-nū', **İsmet** (known until 1934 as **İsmet Paşa**, pā-shā'), Turkish statesman: b. İzmir, Turkey, Sept. 24, 1884. Educated in Turkish military schools, he was commissioned a lieutenant in 1903, and during World War I served as chief of staff for Mustafa Kemal (later known as Kemal Atatürk, q.v.). When the Greek Army invaded Turkey in 1921, İsmet led guerrilla forces to delay it and won a notable victory at the village of İnönü. At the Lausanne Conference (1922-1923) he negotiated a peace treaty with Greece and won recognition for the Turkish republic. He became the first prime minister of the new republic in 1923 when Mustafa Kemal was elected the first president, and together they began the progressive westernization of Turkey. When Turkish law (1934) required that all citizens adopt surnames, İsmet Paşa became İsmet İnönü in memory of his victory at that town. He resigned as prime minister in 1937, but after the death of Atatürk the following year, he was unanimously elected president and held that office until 1950.

An authoritarian president, though not quite a dictator, he continued the process of westernization in Turkey. In international affairs he proved himself to be an astute diplomat, skillfully preserving Turkey's neutrality throughout World War II; and he won great respect abroad by his gradual introduction of democracy in Turkey. In the late 1940's he allowed the formation of opposition parties, and in 1950 he supervised the first completely free elections in Turkish history. His People's Party was then defeated by the new Democratic Party led by Celâl Bayar.

INOUE or **INOUE**, ē-nō-ō-yē, **MARQUIS KAORU** or **KAARU**, Japanese statesman: b. Yamaguchi, Japan, Jan. 28, 1835; d. Tokyo, Sept. 1, 1915. A samurai, or lesser nobleman, of the powerful Choshu clan, he recognized the necessity of westernizing certain aspects of Japanese civilization, and in 1863 made a secret trip to England with Hirobumi Ito (q.v.). After two years of observing Western methods, he returned to Japan where he was a leader in the reform movement highly brought about the Meiji Restoration in

1868. Inoue contributed to the reorganization of government finances and served as minister of finance in three of Ito's cabinets. In addition he headed at various times the ministries of foreign affairs, internal affairs, agriculture and commerce, and in 1895 was sent to reform the government of Korea. He retired in 1898, but during the war with Russia (1904-1905) was an adviser to the finance minister. His services to the state were rewarded with the title of count in 1885 and of marquis in 1907.

INQUEST, ĩn'kwēst, in law, a body of men appointed to determine facts; also, the inquiry itself or its findings. In its broadest sense it is synonymous with the term "inquisition" and covers any judicial inquiry. In practice, however, it is restricted to certain special proceedings and should be carefully distinguished from ordinary jury proceedings, which find facts in the customary form of trial between adversaries. An inquest may be an official investigation to establish undisputed facts so as to make them a public record. It may also be an impartial inquiry which may hear evidence of multiple possibilities. The *grand inquest* is the grand jury, whose power of inquest includes the right to go further into matters before it than the evidence presented, when it sometimes is called a "runaway jury."

The *coroner's inquest*, which investigates the causes of sudden or suspicious deaths, is a typical and perhaps the most familiar kind of inquest. Here the coroner (whose office in some jurisdictions is now filled by a "medical examiner") sits as a quasi judge with a jury which determines whether a death was a murder, suicide, or the result of natural or other causes.

An inquest proceeding may determine the amount owed by a defendant who lost his suit by default. Such an inquest may be conducted by a sheriff or the court itself; in either case a jury may or may not be used. Another common inquest is that of lunacy, whereby a finding is made as to an individual's mental competence to manage his affairs. An *inquest of office* determines whether or not the government owns land by forfeiture or escheat. It was common when land was held in military tenancy direct from the crown.

JOHN M. WILLIAMS, JR.

INQUILINE, ĩn'kwī-lin, a zoological term applied to animals which are nonparasitic yet live within the homes or bodies of other animals. The term is applied to a great variety of cases ranging from insects living within the nests of other insects to fishes which live as inquilines inside the bodies of sponges. The phenomenon is closely related to commensalism (q.v.), but often it is difficult to imagine that a benefit accrues to each member of the relationship. Commonly, one species invades a part of the habitat of a closely related species, with the host species seeming not to suffer harm nor to reap any benefit from the arrangement. Much modern biological research has focused upon the mechanisms by which inquilines locate and remain within the host or the host territory.

An example is provided by the investigations of John H. Welsh at Harvard University using the mite *Unionicola*, an inquiline which lives in the gills of fresh-water mussels. Welsh found that the mites swim toward light until they encounter a chemical exudate of the mussel, at which time they exhibit a strong negative reaction to light. This causes them to turn toward the mussel and very often to swim into the mantle cavity of the host. This relation-

ship is exhibited by many mussels and mites; however, like most relationships of inquilines and their hosts, it is entirely species specific, which means that a particular species of mite is sensitive only to chemical exudates of its own host animal.

Examples of inquiline relations occur among termites, ants, and bees, and are especially known among gallflies (see GALLS).

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INQUISITION, The. In ancient Roman Law, and in the Papal Canon Law which grew up from it, two forms of criminal procedure were recognised, the Accusatorial and Inquisitorial. The former is familiar to us all; a definite prosecutor called into court a definite defendant, and sought to prove his case by ordinary forms of testimony and pleading. The second, however, needs explanation. Under this procedure, a great part was played by *fama*; that is, by *report*, not in the loose sense of "common rumour," but as the testimony of two or three knowledgeable and trustworthy witnesses. When such a *fama* reached the ears of judicial authorities, then the man was *infamatus* (or *diffamatus*) of the offenses in question. The judge then became his accuser: "You are *diffamatus* of such and such an offence: therefore you must appear before me and clear yourself on oath, and if possible by the oath also of a specified number of competent witnesses." Thus an inquiry (*Inquisitio*) is set up; and, whereas under *Accusatio* the burden of proof would have rested upon the prosecutor, it is now laid upon the defendant. To grasp this clearly is to understand, from the very first, why the medieval Inquisition never struck full root in England, where the Common Law was a natural growth of English life, "broadening down from precedent to precedent."

It was equally natural that inquisitorial procedure came to be generally and intimately associated with questions of religious belief.

Here again, we cannot understand the Middle Ages so long as we ignore the eschatology of that period: men's current convictions in the matter of Heaven and Hell. During more than a thousand years, the orthodox belief was one of almost inconceivable severity. Hell was conceived as a place of torment infinite in duration, and indescribable in its horror. Moreover, it was assumed that the great majority of mankind were destined to this eternal torment. St. Thomas Aquinas, quite as a matter of course, contrasts the "few" of the saved with the "multitude" of damned. St. Bernardino (d. 1444), from whom as a Franciscan we might expect special human sympathy, even taught that the Harmony of the Universe necessarily demanded this contrast; that the Music of the Spheres would have been imperfect but for the bass part supplied by the howling of the guilty multitude.

These ideas had reigned from time immemorial, and the most unforgivable of all delinquencies was deathbed impenitence: *Extra Ecclesiam nulla salus*. In such an atmosphere as this, the most horrible social crime was that which dragged down to Hell not only the heretic himself, but perhaps thousands of perverts with him. Therefore Pope Innocent III, in 1199, formally condemned heresy as the most unpardonable of treasons, "since it is far more grievous to sin against the eternal than against an earthly Majesty." This memorable decree laid the foundation of the Inquisition as an institution unprecedented

in world history. It was upon this basis that St. Thomas Aquinas bent his genius to build the theory which his faithful followers have held down to the present day. "If false coiners or other felons are justly committed to death without delay by worldly princes, much more may heretics, from the moment that they are convicted, be not only excommunicated, but slain justly out of hand." (*Summa Theologica*, 2^a 2^{ae}, Quest. xi, art. iii).

The Roman Church—*Ecclesia Romana* as it was commonly called in the Middle Ages—claimed then, and has never since renounced, the philosophical title of *Societas Perfecta*: a state in its own right, with powers of legislation over all its subjects and the sanction of punishment over the disobedient, even to the extreme penalty of death. It claims that its subjects are all men or women who have received Christian baptism, whether deliberately or as infants at the font.

For the claims of the state in matters of conscience, see Bishop Creighton in his *Persecution and Tolerance* (1895). The early Christians had differed much from each other; nearly a hundred sects developed in the first hundred years. In some cases there were mortal enmities; in others we find remarkable tolerance, as when Justin Martyr, the earliest surviving apologist (160 A.D.) condemns only those who reject the faith with contumely, and honors with the title of Christian such pagan philosophers as Socrates and Heraclitus, since they lived for the truth, and Christ is Truth. In a later generation (200 A.D.) Tertullian gloated over the hell-pains awaiting pagan torturers, in a passage rendered notorious by Gibbon and Lecky; but this was when the unpopular sect had been embittered by persecutions. Presently, the tables were reversed, and Christianity was victorious under Constantine I.

In the great domestic quarrel provoked by Arius (325 A.D.), the emperor finally sided with the majority of bishops. He banished the heresiarch, commanded under pain of death that all his books should be surrendered, and sent him into exile with the two bishops who still maintained his cause. From that time forward the state made itself responsible for government in the church. Heretical priests were punished. Paganism was condemned as a *superstitio*, and the pagan temples were disestablished and plundered with even greater thoroughness than Henry VIII showed in the England of 1530.

In 381, the Emperor Theodosius set his seal to a series of enactments which punished heresy. In 385, the heretic Priscillian was executed by the Emperor Maximus, despite the protests of St. Martin of Tours. A generation later St. Augustine, who at first had pleaded for tolerance of the Donatists, emphatically revoked this in course of time, appealing to what seemed practical experience, since confiscation of property and other similar penalties are efficacious in calling men's attention to the orthodox faith. A generation later (438) Theodosius II published his celebrated *Code of Roman Law*, in which, *inter alia*, are severe laws against pagans and heretics, thus giving the Church the status of a *Societas Perfecta*, with legislative and punitive powers.

There was now a lull in religious manslaughter; Europe was too troubled, and too barbarous, for any important anti-clerical movement to come into collision with the hierarchy. But, all this while, there was gradual infiltration of organised heresy from the East. The Manichaean creed had

just enough in common with Christianity to be a dangerous rival. St. Augustine himself had been a Manichaean in early life, and had found the heretics formidable enemies in his African bishopric. The gloom of the Dark Ages (6th to 11th century) from which very few intimate social records have survived, doubtless hides much underground nonconformity. But when we come to that religious and intellectual revival which deserves to be called the Renaissance of the 11th century, we suddenly find heresy very much alive. The chronicler, Ralph Glaber, a Cluniac monk, tells us how, around the fateful year 1000, "it seemed as if the world shook itself and cast off its hoary age, and clad itself everywhere in a white robe of Churches." Yet this light fell upon a barbarous world.

"It is horrible to relate what corruptions then prevailed among men." There were plagues and famine and cannibalism among the multitude; and in the Church itself, Glaber stigmatises the debaucheries of one pope (Benedict IX) as "too horrible to relate," while he accuses the whole clergy as demoralized by greed, and infected from the head with the mortal sin of simony. In such a world as this he describes four pestilent outbreaks of heresy in the most civilized parts of Western Europe; and from this time forward the chain is complete, down to the Renaissance and Reformation. We find four fairly definite periods: Lynch Law, Civil War, Episcopal Inquisition, and Papal Inquisition.

The "white robe of Churches" came in a period of Lynch Law. The lay authorities, as a whole, were definitely hostile to the innovators, and the multitude could be raised against them. Here and there, a bishop or priest can be found more merciful than the mob, but this is very rare, and we may apply the legal maxim: *Fecit qui profuit* (He did the deed who profited by it). For to the clergy this was a matter of life and death. Religious changes involve social revolution, and heresy threatens violence and plunder. The totalitarian claims of Rome, while on one hand they gave her increased power, rendered her otherwise vulnerable in many directions. Thus, during the 11th century, both sides mobilized their forces, and, by 1100, all tended to civil war. It was a time of rapid advance in the arts of peace and civilization. The monastic orders grew apace; the hierarchy and the feudal nobility were better organized and disciplined, and it became increasingly impossible to drift onwards on a system of Lynch Law and guerrilla warfare. Orthodoxy and Heterodoxy mobilized their respective forces; until, at last, in the 12th century, came civil war on a great scale.

On the eve of this explosion, we have a most significant sidelight from the Rhineland, which shared with northern Italy and southern France the credit of greatest advance in civilization. This is an exchange of letters between Erwin, Prior of Steinbach near Cologne, and Bernard, who stands beside St. Francis among the greatest of canonized saints. He was learned, eloquent almost beyond all of his age, and fearless in his dealings with popes and princes: Pope Eugenius III had been one of his pupils. About 1130 A.D. he had made a special missionary journey among the heretics of southern France, the land of the Troubadours. Here the saint, confessedly, met with little success. Erwin now wrote describing his own difficulties with organized heresy in the Rhineland. The folk described by Erwin answer to those Beg-

hards, Béguins, Béguines who, after long hesitation on the verge of revolt, finally plunged or were thrust into the abyss, and were in the 13th century identified or confused by Bernard Gui with "spiritual" Franciscans. Here, under Erwin's pen, they appear far more nearly akin to the later Vaudois. The good prior found them attractive; and therein lay the difficulty. Their lives seemed blameless; and these unbelievers boldly challenged the multitude of believers with Christ's criterion: "By their fruits ye shall know them."

That was a mystery for St. Bernard also; he had often deplored that his Church set a bad moral example; she was preyed upon by a cancer, and the remedies seemed only to make her worse. He was constrained now to admit the apparent regularity of these men's lives, and even their frequent semblance of piety. The heretic "is pale with fastings; he eats no bread of idleness; he works with his hands for his livelihood, where then is the fox?" It lies in their contempt of Church authority: they "give holy things to the dogs." They are "a vile and rustic crew, unlettered and altogether unwarlike." Even their righteousness is but as filthy rags; "they do indeed abstain, but they abstain heretically." These words are typical of the spirit which inspired orthodoxy in those days.

St. Bernard is often quoted as an apostle of tolerance, in something like the modern sense; men quote his words: "Faith is a matter of persuasion, not of force." But we must read on for a few lines and we shall find how in his succeeding words he very plainly appeals for the punishment of persistent heretics. (In *Cant. sermo* LXIV. c. 12.) The hierarchy was puzzled; popes and councils had no clear-cut policy. It is not until 1209 that we find a council definitely basing itself upon the plain claim of "Death for the Heretics" as a maxim both of Canon Law and of State Law. Thenceforward, this lies at the very foundation of medieval European society. Meanwhile, things were steadily drifting towards civil war, which broke out in 1195.

Southern France, Languedoc, was more advanced even than the Rhineland. It had a social system far older than the North. It was less warlike, more mercantile, more luxurious, and less papalistic. Jews flourished there, and society was strikingly tolerant of religious differences. In consequence, it had become a favorable ground for the spread of Manichaean doctrines which had filtered in from the East. Recent scholars have doubted whether these Provençal heretics held the creed with Eastern exactness, but there is no doubt of their main features. They held a dualism, an equilibrium between good and evil, God and Satan, which shall endure until the end of all things. Meanwhile, there is perpetual conflict between Light and Darkness, Mind and Matter. The flesh is evil; therefore, true religion is strictly ascetic. Sexual commerce is sinful, even in matrimony. Diet must be vegetarian, rejecting even eggs and everything that has had life, with an illogical exception for fish. Those strict rules, however, were binding only upon the *perfecti*: the multitude, *credentes*, seem in practice to have differed little more from orthodoxy than did the Quakers of the first generations. The whole sect called themselves *Cathari*, "the Pure." They had a hierarchy of their own, with rites and sacraments partly imitated, perhaps, from the Church, but more probably derived from those same sources of Imperial Rome from which the priesthood had

borrowed so freely. They reprobated bloodshed and swearing and set up against the Catholic extreme unction a ceremony which pushed to extremes that fundamental repudiation of the flesh. It was called *Endura*, a religious suicide by starvation or a wet napkin spread over the face on the deathbed.

Jules Michelet (followed by H. C. Lea and Abbé E. Vacandard) judges that it would have been disastrous to civilization if the *Cathari* had conquered in the civil war of Languedoc. But was there any valid reason to anticipate such a victory? The *Endura* itself it not immeasurably more barbarous than some forms of asceticism which orthodoxy has admired; and there is no probability that these *Perfecti* would have destroyed throughout Europe the immemorial institution of marriage, and would have thus involved wholesale race-suicide, as even such a moderate churchman as Vacandard argues. Is it credible that, if St. Bernard had been consistent in leaving the decision to "persuasion, not arms" any more would have been done to depopulate the world than had been already done by a thousand years of monastic celibacy? Swearing, again, is often cited as a crucial point. The structure of medieval society, it is argued, was fundamentally feudal: its elaborate network of legal and customary obligations reposed upon the multiple oaths of fealty, taken publicly on the Gospels, at every turn. But would European culture actually have been wrecked by the obligation to find gradually some firmer basis?

Great churchmen of the Middle Ages complained constantly that this flood of oaths debased the moral currency. No doubt the heretical tenets implied social as well as religious revolution; but it is quite mistaken to represent the men as mere anarchists. Abbé Vacandard condemns severely those modern apologists who press this argument, in flat contradiction with the records. He writes: "As a matter of fact, the Inquisition did not condemn merely those heresies which caused social upheaval, but all heresies as such." In fact, he points out, men were often prosecuted after their death—even 20 or 30 years later. Why should Inquisitors take all this trouble with men whom God had already judged, and who could do no further harm to society? Because, as Vacandard points out, this "almost incredible frequency of prosecutions against the dead" went to fill the coffers of the Inquisition.

The Inquisitor Eyméric, one of our best original authorities, confesses with brutal frankness that the Inquisition of the day (1360) languishes because nearly all the wealthy heretics have been condemned, and this Holy Institution must live upon its scanty pickings from the poor. Thus Catharism and Waldensianism on the Continent, like Lollardy in England, were driven underground. Those three heresies by this time were hammered into some similarity by common sufferings of persecution.

The Waldensians, or Vaudois, were a sort of Bible-Christians founded about 1180 by Peter Waldo, a rich merchant of Lyons, who gave his money to the poor and embarked upon a missionary career founded upon the translation and popular exposition of Scripture in the native tongue. He began as peaceably as John Wesley, but was driven to separation from this totalitarian world which had no room for rival religious organizations. One of Macaulay's most often-quoted sayings is only superficially true—that Rome, unlike

other churches, has succeeded in utilizing religious enthusiasm and keeping the mystic within her bosom. Darwin, when he lived in a country of fir-woods, wondered that the meadows were not full of self-sown firs. It was only by degrees that he realized that thousands of such seedlings were all the time around him, remorselessly cropped by the cattle or the mowers before they had grown recognizable. Microscopic observation of the Middle Ages shows us a similar process among the seedlings of religious nonconformity. The heretics were often, as St. Bernard describes them, obscure and unwarlike. They showed that astounding tenacity of memory which has often been observed in illiterate folk. More than one Inquisitor testifies to their enormous superiority in this field over the parish clergy. Sacconi writes in about 1250: "I have heard and seen a certain ignorant rustic who recited Job, word for word, and many who knew perfectly the whole New Testament." He contrasts this with the "negligence of Catholic teachers." These men, therefore, were most formidable antagonists in an age when books were so few and dear that a Bible cost more than the whole yearly income of an ordinary parish priest.

Bernard Gui (1300) warns Inquisitors that "it is not expedient to dispute concerning the Faith against such astute heretics in the presence of lay-folk." St. Louis, in many ways a most noble character, warned his knights against disputing with an unbeliever; let him rather "thrust his sword into the man's belly, as far as it will go." In about 1230, a certain weaver at Toulouse would say publicly: "lords, hear me! I am no heretic, for I have a wife, and lie with her and beget children, and I eat flesh and lie and swear, and am a faithful Christian." In 1247, another Toulousan, Pierre Garcias, burst out: "If I could lay hold on that god who, out of a thousand men whom he had made, should save one and doom all the rest, I would tear and rend him tooth and nail as a traitor, and would count him as a false traitor and spit in his face."

When the civil war was thoroughly kindled there was little to choose between the combatants in frenzy of conviction or brutality of methods. The Catholics at one moment tore out their prisoners' eyes and cut off their noses, claiming just right of reprisals. When the Catharist city of Béziers was stormed (1209) by Simon de Montfort's Crusaders, Innocent's cardinal legate reported to the pope that "our men, sparing neither rank nor sex nor age, slew about 20,000 souls" and pillaged the whole city. The contemporary papal chronicle puts it more tersely: "almost all were slain." Innocent, without a word to hint that his Crusaders had done more than their strict duty, wrote now to congratulate them on the remission of past sins and the accession of worldly wealth which they will have earned through their obedience to the vicar of Christ.

It is sometimes urged that the procedure of the Inquisition is not unique: that each separate item can be paralleled from elsewhere. Even though this were true, it would not exonerate the inventors of this particular compound; gunpowder has its own peculiar character and peculiar effects even though sulphur, charcoal, and saltpetre, taken separately, behave very differently. But the excuse itself is fundamentally false. It is contradicted by the best of contemporary lawyers, Bernard Gui, whose *Inquisitor's Manual* has been published, in its most important section, by Messrs.

Champion of Paris at a popular price, with French translation. Bernard writes clearly that *Multa sunt specialia* in Inquisitorial procedure. He specifies a concrete instance: whereas other courts demanded a minimum of two witnesses against the suspect, the Inquisition often acted upon a single testimony. Its main characteristics were, briefly, as follows:

(1) The fundamental bias has already been described, the man was *defamatus*, and bore the burden of proving his innocence.

(2) His judges were purely ecclesiastical, and therefore prejudiced against him: the civil power strove vainly to secure even the right of consulting the documents.

(3) The procedure was secret.

(4) As a rule, the names of witnesses were also concealed; they might be partial or even infamous persons, yet the suspect had no chance of challenging them but at random.

(5) In fact, infamous persons were explicitly admitted to testify though in other courts their testimony was altogether refused.

(6) So, again, children were admitted to testify adversely, whereas neither the infamous person nor the child might speak in defence.

(7) Advocates were at first allowed, but if the person was proved guilty, the advocate had to share his punishment; this was so shamelessly exploited that, finally, even the pretense of advocates for the defense was abandoned.

(8) It was equally hopeless to rely upon favorable witnesses; for they were pretty sure to get into trouble as abettors of heresy.

(9) Torture might be inflicted not only on the suspect, but also upon any witnesses whom it was hoped to enlist for the prosecution.

(10) This had, in practice, no legal limits. It was indeed forbidden to *repeat* torture; but the man who had been racked on Monday might be racked again on Tuesday under the excuse of *continuation*.

(11) A very small nonconformity might be magnified into a deadly crime.

(12) The medieval Inquisitor pushed in where the pagan of ancient Rome had disdained to tread. When Trajan commissioned Pliny to persecute, he forbade the seeking-out of secret Christians. Yet the medieval heretic had no such immunity. Every man was bound in strict conscience to spy upon and denounce his neighbor.

(13) There were other rigors, of which the result is that an acquittal, pure and simple, is almost unheard of in these records. Very seldom was there less punishment than the yellow Crosses of Infamy, about a foot long, to be worn night and day upon every garment but the shirt, which held the victim up to the mockery of the multitude.

In Bernard Gui's *Register* (between 1249 and 1258), among 200 suspects, there is not a single acquittal. In his whole lifetime he convicted 930, of whom 42 were burned. Of the rest, 307 were condemned to prison; and all 930 were liable to total confiscation of their goods.

A word must be added concerning those two items, prison and confiscation. The former was frequently used as a most serviceable weapon in the war of nerves. "Confess, or you shall go to prison," was generally effective with men who knew very well what sort of dungeon this was. As to confiscation, it will be seen how far this went to supply the sinews of war.

One most important point must be noted be-

cause it is so frequently alleged by apologists. The Church, it is argued, explicitly repudiates the shedding of blood; she only condemned the heretic as a theological question undoubtedly within her competence. Then she handed on the condemned man to the civil power, "the Secular Arm." The latter, however, had no option but to burn him. Any magistrate who refused would himself be liable to be burned alive. So the hierarchy could preach "*Ecclesia abhorret a sanguine*." "Let us call it a legal fiction," writes Abbé Vacandard apologetically. Most people probably will give it a more invidious name.

Here then, was a lethal weapon, an invention as elaborate and as devastating in its own way, as gunpowder. It was inevitable that despotism should seize upon it as a ready tool. Even its spectacular sides, its cross of infamy and campaigns of blood and flame, were not so deeply operative as the leaden pressure, ubiquitous and unrelaxing of centuries of tyranny. History shows us this, in the rule of the Arian anti-Catholic invaders of Africa, and in the far milder, but still very regrettable, rule of Elizabeth in England and in Ireland.

From the year 1239 onwards, most Europeans lived under a terror which was not less harmful for being so often unconscious. England, it is true, with her greater political freedom than the Continent, suffered only twice from the Inquisition proper. In 1311, Philippe-le-Bel of France, with Pope Clement V as his uneasy partner, used it as a tool for disreputable political ends: the destruction and pillage of the Templars. The unscrupulous use of torture in France, produced a series of confessions which nobody believes now, and which, indeed, were often revoked by the victims themselves outside the torture-chamber. In England, no cogent evidence could be found, because the English courts permitted no torture. Therefore Clement approached Edward II with a bribe and a threat: Obey, and we give you plenary absolution for past sins; disobey, and you fall under excommunication. Edward yielded "out of reverence for the Holy See," and enough evidence was scraped together to justify the desired confiscation and pillage. During Mary's reign, again, the Inquisition was revived in England for a few months.

There are three other outstanding instances of the Inquisition used as a political weapon in the Middle Ages. In 1318, Pope John XXII let it loose upon the "Spiritual" Franciscans, so that his Inquisitors condemned and burned, as impenitent heretics, four men whose recorded offenses amounted only to this, that they clung obstinately to the primitive simplicity of Franciscan garb and manners, even in face of the pope and the Franciscan officialdom of that day. Again, in 1430, Joan of Arc was condemned for witchcraft (her real crime being her noble patriotism) by a judge who was a tool of the English conquerors. It was not until our own days that she was formally sainted by her own church. Once more, in 1498, the friar Savonarola was burned for his political and social opposition to the Medici family and the notorious Pope Alexander VI. He was put seven times to torture with slender results. "It would be easy," writes Abbé Vacandard, "to cite many instances of the same kind, especially in Spain."

The Inquisition in Spain.—Medieval Spain was almost equally divided between three religions—Christian, Moslem and Hebrew. Paradoxically, this led on the whole to tolerance, since none of

the three saw any proximate chance of "liquidating" completely the other two. There were occasional resorts to formal Inquisitorial methods, and sometimes anti-Semitic explosions even on an extensive scale, and the Moslem population formed standing political difficulties; but these were mostly dealt with on the *solvitur ambulando* principle. Jews and Moslems arrived at some of the highest positions in State and even in Church; and on all hands the quiet infiltration was enormous. This very fact of Semitic ascendancy largely motivated the great anti-Semitic movement of the 15th century, in which many thousands of Moslems and Jews had no choice but between "conversion" and death, and where St. Vincent Ferrer, for instance, is recorded by his partisans to have baptized four thousand in a single day. Hence came a dizzy multiplication of "New Christians" (*conversos*, popularly labeled *Marranos*, swine) who dominated the laboring and professional classes of Spain. Pogroms became frequent; and here, as elsewhere at earlier dates, the Inquisition substituted some sort of legal regularity for mere lynch-law.

Queen Isabella of Castile, "The Catholic," obtained the formal foundation of the Inquisition from Pope Sixtus IV. It began operations in 1480; her husband, "Ferdinand the Catholic," joined her whole-heartedly; and gradually the institution struck root throughout the peninsula. Sixtus did indeed send another bull severely criticizing its methods; but his objections were ignored. The two sovereigns, from the first, used it as the foundation of their political despotism. Thenceforward, from century to century until 1834, it was the most characteristic of Spanish institutions.

Its methods were medieval, "writ large." Church and State were here in complete fundamental accord; kings and popes might quarrel over details, but those were the quarrels of lovers. An able Roman Catholic writes very truly: "No church could be more arrogantly national than the Spanish, fenced around as it was with exemptions, royal, episcopal, monastic. But none was ever more Catholic. It bred neither heresy nor schism." Confiscations, beyond even the medieval scale, ensured enormous revenues which supported both royal splendor and the Roman religion to an extent never surpassed in history. In the 16th century, when Spain gathered also immense revenues in bullion from the New World, she bade fair to dominate Europe. That was her Golden Age in literature and art, the age of Cervantes and Velasquez. But this was at the cost of a royal and aristocratic extravagance, of an unabashed financial corruption, and of a burden upon the working classes, which have seldom been equaled for so long and on so large a scale.

Inquisitorial statistics have often been handled in irresponsible fashion; in most cases of wide divergence it is safe to take the lower figures. At the first *Auto de Fé* (Seville, 1481), six persons (men and women) were burned. Within the next eight months, 292 more were burned, 98 imprisoned for life; many more were torn from their graves in order to justify confiscation of their property. Under Tomás de Torquemada (q.v.) the tempo rose considerably. He was appointed Grand Inquisitor in 1483, making this institution "the first act of United Spain." Under Philip II (1569) the principles of the Inquisition were transplanted to Mexico, where 879

trials took place in the next quarter of a century. Meanwhile, the revolt of the Low Countries, costing a murderous war before Belgium was brought to heel and Holland finally severed from Spain, must be put down mainly to the score of the Inquisition. In Portugal a little later (1651-1673) the records show 184 burned alive, 59 burned in effigy with confiscation, and 4,793 penanced. As many as 1,500 "penitents" were paraded on one single occasion.

Within those postulates of Spanish political thought, it was only logical to carry out persecutions or deportations of Jews and Moors, sometimes piecemeal or again on an enormous scale. The Jews were banished by law in 1492, from which time onwards the country was filled with Jewish *Marranos*. Those who remained constantly fed the *Autos de Fé*, while those who escaped enriched the commercial and cultural life of other countries: everywhere they founded respected communities, as in Amsterdam, Hamburg, London and New York. The *Moriscos*, on the other hand, finally added to their minor and continual political sufferings one of the most picturesque tragedies of all time, the mass-deportation of the whole Moorish population, insofar as such completeness was fully possible, between 1609 and 1615. The few who remained were strictly forbidden all use of their ancient language and customs. National life was thus impoverished by the loss of its most laborious factor. By a strange irony of history, the most recent victory of physical force in Spain was won by an orthodox general (Francisco Franco) commanding an enormous proportion of Moorish soldiers, and foreign mercenaries.

The 18th century showed gradual decay of the Inquisition, but only in proportion to the decay of the whole country, which is calculated to have lost 50 per cent of its population since the days of Ferdinand and Isabella. In 1808 Napoleon abolished it, and its resurrection lasted only until 1834. But there remained an incalculable debt for past errors and crimes. The Comte de Montalembert, a fervent Catholic, contrasted the racial virtues of Spain with her political and social decadence in 1800: "She has fallen from gulf to gulf, from despot to despot, from favorite to favorite."

Modern apologists avoid dealing with the reluctant confessions of many among the most eminent Roman Catholic historians. Cardinal Richelieu, a realistic statesman who shrank from few deeds that his policy demanded, described the expulsion of the *Moriscos*, in his *Memoirs*, as "the boldest and most barbarous counsel recorded in the history of all preceding ages." Montalembert wrote "I grant indeed that the Inquisition in Spain destroyed Protestantism in its germ; but I defy anyone to prove that it has not given it throughout Europe the support of public opinion and the sympathies of outraged humanity. It has created in both worlds inexhaustible nourishment for impiety, and for the hatred and discredit of Catholicism." Lord Acton, his contemporary and a far greater historian, was even more emphatic. "The Inquisition is peculiarly the weapon and peculiarly the work of the Popes . . . No other institution, no doctrine, no ceremony is so distinctly the individual creation of the Papacy, except the Dispensing Power. . . . It was the negation not only of religious liberty, which is the mainspring of civil, but equally of civil liberty, because a government armed with the machinery of the Inquisition is necessarily absolute."

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INQUISITIVE WOMEN, in-kwiz'i-tiv (LE DONNE CURIOSÉ), an opera in three acts by Ermanno Wolf-Ferrari (libretto adapted by Luigi Sugana from a Carlo Goldoni comedy) first produced in Munich in 1903. The first dramatic work of the composer to secure more than local notice, this opera, or "musical comedy," as he terms it, quickly achieved worldwide success by reason of its vivacity and delicate charm. Of German and Italian parentage, Wolf-Ferrari was an eclectic. The artistic lineage of *Le donne curiose* is plainly traceable to Mozart, though both *Meistersinger* and *Falstaff* influences are apparent. The orchestra, effectively used, is relatively a small one and in some respects the treatment harks back to an earlier day, when leading motives were less known. The music is distinguished by lyric simplicity and rhythmical variety. The prevailing character is improvisational, well adapted to the slight tale of harmless intrigue which it accompanies. There are several easily recognized numbers—the trios in the first act, the quartet in the second, Rosaura's love soliloquy and the succeeding pages of almost Mozartean simplicity, the prelude to the last act, the barcarolle chorus, and the final ensemble. There is no great emotional intensity, nor intellectual depth, but means and end are fitted in a thoroughly artistic and satisfying way.

LEWIS M. ISAACS.

I.N.R.I., the letters often graven on a scroll set upon the Crucifix above the head of Jesus. They are the first letters of the Latin words *Iesus Nazarenus Rex Iudaeorum* (Jesus of Nazareth, King of the Jews), the superscription ordered by Pontius Pilate to be placed upon the cross on Calvary (John 19:19).

INSANITY, in-săn'i-ti, in law, the condition of mind which places the person so afflicted in a position of being held not responsible for his conduct or incapable of attending to his own affairs. In practice, *incompetency* is often used to refer to the latter condition, and insanity is confined to matters having a criminal context. The facts are establishable by a jury in an ordinary case, although inquests or commissions are frequently used in the United States where the question is one of incompetency. Such mental conditions can be the subject of expert (opinion) testimony.

Psychiatrists complain that attorneys and

judges speak as if insanity were a specific disease. Actually, it is a legal status, attained by many different medical routes. It is probably true that over the years, attorneys and judges have garbled medical and legal principles alike. But the law must be common to, and acceptable to, all of the people; and although the law reads that a man guilty of a criminal act will not be punished if he was insane at the time of the act nor prosecuted if he has since become insane, opinion today is still clouded as to the purpose of criminal laws—whether they are to protect society, to punish, or to avenge. Thus, when some violent, gruesome crime occurs, as when a child has been sexually molested and murdered, the climate of society may demand that punishment be by execution rather than by incarceration, so that the child will be avenged and future recurrences will be impossible. To accomplish these purposes, the accused must be found sane enough to stand trial, and to have been sane at the time of the act.

The question of responsibility concerns the law more immediately than the type of distress which caused the legal irresponsibility. Thus the test of the law is not, "Is this man a paranoid or suffering from paresis?" but "Did this man know right from wrong?" Another test of the law is whether a person who knows that the act is wrong, but does it anyway, may be said to have acted compulsively, the so-called "irresistible impulse." This allows the law, through the jury as a composite conscience, the chance to be merciful in such cases as crimes of passion or murders of defective children, despite the possible medical inaccuracies involved. If the public wishes to assume the economic burden of treatment rather than of mere incarceration, the law may be able to take a different approach.

The law has a long history of tests to show insanity. After the tribal laws—such as the *manios* of the Greeks and the group *insaniens* of the Romans—and the feudal theocratic views of insanity, came a number of men and trials which evolved the tests basically used still: Thomas Erskine's successful defense of James Hadfield's attempted assassination of George III in 1800; the M'Naghten rules (of right and wrong) in 1843, adopted in the United States in *Commonwealth v. Rogers* (which also used the "irresistible impulse" rule) in 1844; and such earlier writers as Sir Matthew Hale (1609-1676) and Sir William Blackstone (1723-1780). There have also been used from time to time such tests as the wild beast test, the child of 14 test, and other concepts. A case (1956) in the District of Columbia, *United States v. Durham*, refined the statement of these rules to hold an accused not liable "if his unlawful act was the product of mental disease or mental defect."

Even more intricate and difficult matters are involved in judging those who have been called the "not-quite-incompetent incompetents," since on these judgments rests the validity of such things as contracts and wills. In most competency cases, dramatic conflicts of testimony are relatively infrequent, but the requirement of a medical opinion gives a seal of scientific authority to the proceedings necessary to confine a person to an institution or to seize his property for its conservation.

The law has been grappling with these problems for many years, and recognized early the basic questions involved. The legal tests employed have achieved a sort of empirical basis; and it seems probable that this pragmatic ap-

proach will continue unless, or until, the medical profession makes enough progress to relieve the law of this responsibility.

See also MENTAL HEALTH.

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INSCRIPTIONS, *in-skrīp'shūnz*, a term comprising, in its widest sense, all words or word-signs engraved (or painted) on relatively durable materials, such as cliffs, wrought stone, baked clay, metal, or even wood. For reasons of practical convenience, however, certain sorts of inscriptions are grouped apart; for example, legends on coins and the lettering on painted vases. The role of inscriptions in modern times accords in general with the ancient use, but is much less extended; in antiquity, for example, copies of official and religious documents were frequently promulgated in the form of inscriptions. Commemorative and titular inscriptions, however, are still plentifully employed.

See also ASSYRIOLOGY; CUNEIFORM WRITING; HIEROGLYPHICS, EGYPTIAN; HIEROGLYPHICS, HITTITE AND CRETAN; HIEROGLYPHICS, PRE-COLUMBIAN AMERICAN.

INSECTICIDE, *in-sēk'tī-sīd*, defined by the Congress of the United States (36 Stat. 331) as "any substance or mixture of substances intended to be used for preventing, destroying, repelling, or mitigating any insects which may infest vegetation, man or other animals, or households, or be present in any environment whatsoever." Insecticides may be classified by their mode of action or by their chemical composition.

Terms like "stomach insecticide" and "contact insecticide" indicate the way the insecticide enters the body of the insect. A stomach insecticide is eaten and swallowed. A contact insecticide enters through the cuticle. The terms have no significance as to how or where the materials exert their effect. Some substances can enter in only one way; others reach the vital organs in both ways.

Chemically, insecticides may be divided into two broad classes—inorganic and organic insecticides.

Inorganic Insecticides.—These are of mineral origin, the arsenicals being the most important group. Acid lead arsenate, made by combining litharge and arsenic acid, is used to control chewing insects on fruits, such as apples and pears, on flowers, trees, and shrubs, and on vegetables, such as potatoes and tomatoes. It also has some use in treating soil to control Japanese beetle and Asiatic garden beetle larvae and related soil-infesting forms. Calcium arsenate, sold commercially, is not a single compound but a complex mixture of several calcium arsenates and an excess of calcium hydroxide. The product is made from arsenic trioxide by first oxidizing it to arsenic pentoxide with nitric acid and then allowing the solution to react with a slurry of calcium hydroxide. The conditions of temperature, concentration, and duration of reaction are important because of their influence on the physical nature of the product. Commercial calcium arsenate generally is colored pink and is alkaline in reaction. It has been used extensively against certain insects affecting field crops, especially cotton; but it cannot be used safely on apples, peaches, beans, and some other crops because of its burning effect on

foliage and fruit. Paris green, arsenic trioxide, also called white arsenic, magnesium arsenate, sodium arsenite, manganese arsenate, and zinc arsenate also have long been used to control insects. Paris green was extensively employed to control mosquito larvae but has been largely displaced by the new organic insecticides. It is still used by home gardeners and also by commercial growers of potatoes. Antimony, an element closely related to arsenic, is used in the form of tartar emetic in poisons and for combating certain species of thrips.

Certain compounds of fluorine are also employed as insecticides. Sodium fluoride is an excellent roach powder and is also effective against lice on chickens. Sodium fluosilicate may be used in place of arsenic in poison baits for grasshoppers and the European earwig, and it is also a good roach control. The more soluble fluosilicates, such as those of zinc, magnesium, and ammonium, are used in aqueous solution to mothproof woolen goods, as are also the fluosilicates of ethylenediamine and certain other organic bases. Cryolite (sodium fluoaluminate) has proved effective for the control of codling moth larvae in the Pacific Northwest. It has also been applied to tobacco and other crops for the control of chewing insects.

Yellow phosphorus, in the form of a paste containing 1 or 2 per cent of this element, is very effective against rodents and the American roach. Mercuric chloride, although dangerous to man, has been used in ant poisons and for destroying thrips on gladiolus bulbs and for the cabbage maggot and angleworms. Mercurous chloride is also useful for the control of the cabbage maggot. Copper in the form of the basic sulphate present in Bordeaux mixture has some repellent value against flea beetles and is a specific for leafhoppers on potatoes and beans, but its principal use is as a fungicide on potatoes and apples.

Elemental sulphur is a valuable insecticide and fungicide. Large quantities are used in the form of a fine dust to which a small amount of calcium phosphate, magnesium carbonate, or other conditioner is usually added to prevent caking and ensure free flowing through a dusting machine. These dusts are applied to combat the citrus thrips in California, fleahoppers on cotton, and the potato leafhopper on beans, as well as spider mites. Powdered sulphur is also mixed with derris, pyrethrum, Paris green, and other materials for use against many species of insects. Wettable sulphurs, prepared by grinding sulphur with a gum and sodium silicate or with certain wetting agents, are similarly used as sprays. Lime-sulphur solution is used against scale insects on fruit trees and the potato psyllid, and also as a fungicide. The consumption of this material for the control of scale insects has declined, being replaced in part by oil emulsions.

Organic Insecticides.—These are compounds of carbon in combination with one or more elements, such as hydrogen, oxygen, sulphur, nitrogen, phosphorus, chlorine, and bromine. Unlike the inorganic insecticides, the organic insecticides do not possess a specific element, such as arsenic, to which toxicity may be ascribed. Insecticidal action is due to a definite arrangement of the elements within the molecule and to the molecule as a whole rather than to a specific element or combination of elements.

For convenience, organic insecticides may be

divided into three broad classes: (1) those of animal origin; (2) those of plant origin; (3) those prepared synthetically. The first class includes fish oils, which may be derived from either plant or animal life of former geological periods. Owing to their comparatively low toxicity, materials of animal origin do not appear to be promising sources of insecticides.

Tobacco, pyrethrum, derris, and *Lonchocarpus* (cube or barbasco) are the more important plant insecticides. Quassia, sabadilla, and hellebore are of lesser value. The insecticidal principle in tobacco is nicotine, which is largely used as an aqueous solution of the sulphate. When mixed with soap this solution is very effective against many sucking insects, particularly aphids. Pyrethrum flowers, a species of chrysanthemum, are grown largely in central Africa (Kenya, Belgian Congo, Tanganyika). As many as 20 million pounds of pyrethrum have been imported into the United States in a single year. Pyrethrum mixed with talc or other diluent is used against cabbage caterpillars and other agricultural insects. Its principal use, however, is in the manufacture of sprays and aerosols for combating household insects.

Derris and *Lonchocarpus* roots are imported from Indonesia and South America, respectively. These roots contain rotenone as well as other active principles. The high potency of rotenone against insects is realized from the fact that it is 15 times as toxic as nicotine to the bean aphid and 30 times as toxic as lead arsenate when fed to silkworms. More than 3 million pounds of these roots are now imported annually for the preparation of dusts and extracts. The dusts, made by mixing the pulverized roots with clay or talc, are used to combat cabbage caterpillars, the Mexican bean beetle, the pea aphid, the pea weevil, and some other insects. The powdered roots may also be suspended in water and used as sprays. The extracts are often mixed with pyrethrum extracts or certain synthetics for incorporation in household fly sprays. An American plant, the devil's-shoestring, also contains rotenone in its roots, and it may be possible to produce this valuable insecticide in the United States. Hellebore is used to a limited extent as a mild stomach poison, particularly against currant worms. The use of quassia as an insecticide is limited largely to the control of aphids on hops.

A large number of plants yield essential oils, and many of these, such as the oil of citronella, are mosquito repellents. Geraniol, a constituent of Java citronella oil, is used to lure Japanese beetles to traps. Pine tar oil, produced by the destructive distillation of longleaf pine, has been used to protect animals against the screwworm fly. Petroleum oils also are used to control insects. For application on growing plants they must be carefully refined to remove the greater portion of the unsaturated compounds. These oils, emulsified in water with soap or other emulsifying agent, have to a considerable extent replaced lime-sulphur solution for the control of scale insects on fruit trees. The lower boiling fraction, such as kerosine, is used as a vehicle for extracts of pyrethrum or derris or various synthetics to make household fly sprays.

A large number of synthetic organic compounds highly toxic to insect pests have been discovered and developed since the early 1940's. The products that have attracted greatest attention may be divided into four broad classes—

chlorinated hydrocarbons, organic phosphorus compounds, compounds that are especially useful with pyrethrum, and synthetic pyrethrinlike esters. The last mentioned compounds are almost identical in structure with the insecticidal principles in natural pyrethrum, and, like these, exert a rapid paralytic action on insects. This is especially important in controlling disease-carrying insects.

The chlorinated hydrocarbons that have attracted widest attention are DDT, TDE (DDD), methoxychlor, benzene hexachloride, chlordane, toxaphene, heptachlor, aldrin, dieldrin, and endrin. A number of organic phosphorus products have been widely explored and found to be especially useful in controlling a wide range of agricultural insect pests, including mites and such soft-bodied insects as aphids, thrips, and mealybugs. Among the phosphorus compounds that have been widely studied are parathion, malathion, demeton, tetraethyl pyrophosphate, DDVP, and Phosdrin. Piperonyl butoxide, sulfoxide, propyl isome, and MGK 264 are coined designations for products that have been especially useful in increasing the effectiveness of pyrethrum. Sesamin, a minor constituent of sesame oil, is also of value for this purpose. Such materials are known as synergists.

Many materials are used as fumigants. The oldest is sulphur dioxide, which is highly effective against bedbugs and other household insects; but is now seldom used because of its corrosive and bleaching action. Carbon disulphide has been extensively used to kill weevils in grain; but on account of the fire and explosion hazard, less dangerous materials have been put on the market. Among these are chloropicrin, ethylene dichloride, propylene dichloride, methyl bromide, and a mixture of ethylene oxide and carbon dioxide. These materials are relatively free from fire hazard and have come into large-scale use for the fumigation of all sorts of stored products. Hydrocyanic acid is employed for the fumigation of buildings and ships. A dichloropropane-dichloropropene mixture finds extensive use as a soil fumigant.

Other organic insecticidal materials include soaps, which are effective against aphids but are generally used with other more potent materials, such as nicotine, and also to emulsify oils in water. The neutral oils from coal tar have a limited use as dormant sprays, but are too injurious to plant life to be applied during the growing season. Naphthalene is used in the manufacture of moth balls and is also valuable as a soil fumigant against wireworms. Paradichlorobenzene is used to combat clothes moths and the peach borer. Coal-tar creosote is the principal wood preservative for impregnating telephone poles, fence posts, and railroad ties, and has been widely used in constructing chinch bug barriers and for proofing timbers against termites. Sticky flypapers are made from castor oil and rosin, and the latter is also used in making soaps. Rosin residue, a tacky material remaining after the distillation of rosin, is a valuable adhesive for use with derris powder. Beta-naphthol is used in corrugated-paper bands which are placed around the trunks of apple trees to trap and poison codling moth larvae; metaldehyde has shown surprising efficacy in the control of slugs, and diphenylamine is recommended for application to wounds on domestic animals to protect them against screwworms (blowfly larvae).

Angelica seed oil and a synthetic organic chemical, sec-butyl 6-methyl-3-cyclohexene-1-carboxylate are highly attractive to the Mediterranean fruit fly. Since the 1940's extensive studies have been under way to find chemicals repellent to mosquitoes, chiggers, and biting flies. Benzil and benzyl benzoate are repellent to chiggers; dimethyl phthalate to mosquitoes and mites; 2 ethyl-1, 3-hexanediol, Indalone, and dimethyl carbate to mosquitoes, chiggers, and fleas. A mixture of Indalone, dimethyl phthalate, and the ethyl hexanediol is used as an all-purpose insect repellent. N N-diethyltoluamide has been found to be an outstanding all-purpose repellent.

Useful information on insecticides, as well as on the more than 6,000 species of injurious insects against which insecticides are employed, will be found in publications of the Entomology Research Division of the United States Department of Agriculture. Various state agricultural experiment stations also issue information on this subject.

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INSECTIVORA, ĭn-sĕk-tĭv'ô-râ, an order of mammals that feed chiefly on insects. It includes the shrews, moles, and hedgehogs. Insectivores exhibit many characteristics of primitive mammals, including small cerebral hemispheres in the brain, incomplete palate, and certain peculiarities of the teeth. The living species, together with fossil relatives from as long as 50 million years ago, comprise the animals most closely related to the first placental mammals. The order never has been represented by many species and even today is predominantly restricted to highly specialized environments or isolated islands, as is the case with surviving members of any primitive group.

The first insectivores, known through fossils from the Cretaceous deposits of Mongolia, resembled modern hedgehogs. Moles and shrews evolved later, but the size of the various insectivores never increased much more than in the first small hedgehogs. The largest member of the group is the tenrec, its tailless body measuring about 20 inches in length. A related form, almost as large, is the *Solenodon* of Haiti and Cuba, which looks like a rat with an elongated snout. Perhaps the greatest concentration of insectivores occurs on the island of Madagascar, presumably because the long isolation of that island from the mainland has protected the insectivores from competition with other placental mammals. The most important of the insectivores for students of evolution is undoubtedly the elephant shrew (*Macroscelides*), a small hopping ratlike animal with a greatly elongated snout. It is found in Africa and is almost unknown as a fossil, but shows many affinities to the tree shrews, which are usually considered among the primate mammals, the same order to which humans belong.

The living insectivores have paid a heavy price for survival, their ability to adapt them-

selves to any changes in environment being limited by their peculiar specializations. The moles (*Talpa*) have forelegs or both pairs of legs specialized for digging, but have lost their eyes and require a very humid atmosphere for survival. Outside their humid burrows they perish from desiccation in a very short time. The shrews escape detection by invading habitats placing a strong selective advantage upon small size, but the great increase in body surface relative to body mass leads to rapid heat loss, and no doubt partly for this reason they have to eat every few minutes, day and night. Physiologists report that shrews have higher rates of oxygen consumption in relation to body weight than any other mammals, and a brief shortage of food is sufficient to kill the animal by interfering with the maintenance of its rapid metabolic rate. The span of life of most insectivores is also comparatively brief, even under optimal conditions. See also HEDGEHOG; MOLE; SHREW.

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INSECTIVOROUS PLANTS. See CAR-NIVOROUS PLANTS.

INSECTS, ĭn'sĕkts, the common English name applied to those small animals variously known as springtails, grasshoppers, locusts, cockroaches, walking sticks, termites, dragonflies, bugs, lacewings, beetles, weevils, moths, butterflies, mosquitoes, fleas, flies, ants, bees, wasps, and by many other names. To the layman they are all "bugs." It is interesting and important to note that insects constitute the world's largest group of animals from the point of sheer numbers and kinds.

For some 250 million years insects have flourished on land and in fresh water and to a much lesser degree in salt and brackish water, in Arctic wastes and tropic jungles, and in barren deserts and grassy prairies. This is because they have developed special and elastic adaptations to meet all the varied conditions and changes that have occurred on the earth during this long period of time. Yet during these aeons insects have not been greatly altered either in size or form. Their capacity for survival cannot be underestimated.

The remarkable female has been the founder, the perpetrator, and the multiplier of the species. An Australian queen termite may lay up to 360 eggs in an hour and as many as a million in her lifetime, thought to be from 6 to 15 years. In certain species of aphids in particular, the female is the only sex; males either do not exist at all or occur only occasionally. This phenomenon, known as parthenogenesis (reproduction without fertilization by the male sperm), is common among these fragile insects and not unusual among many other insects. Most of the common species of aphids reproduce in this manner throughout the spring and summer, and may continue in this way almost indefinitely. In the colder temperate regions sexual forms appear in late fall and winter. After mating, the females lay eggs on the host plants, and all living forms perish during the winter.

Another very interesting phenomenon, in which there is more than one form of the same sex, is known as polymorphism. This is well illustrated by plant lice of the genus *Periphyllus*,

all of which live and feed on maple trees. As many as 17 distinct forms occur within the ordinary life cycle of one year. The most important links in the chain of individual forms are minute, microscopic females which estivate on the leaves of the tree, producing sexual forms in the fall of the year. The latter lay the overwintering eggs, and all adult forms perish during the winter. Polymorphism really reaches its peak among termites, especially in the Australian genus *Eutermes*, which has differentiated into no less than 32 species.

Of all the methods of insect locomotion, flight is the most wonderful and important. The light, stout, muscular bodies and strong, light wings of some insects make them masters of aerial maneuvering and enable some of them to travel great distances. Certain locusts regularly migrate every year. Some make relatively short flights, whereas others may travel 100 or more miles, thus becoming international problems because they lay eggs which attain adulthood in one country and then migrate to—and devastate—another country miles away.

Most insects make dispersal flights of short distances during the spring, summer, and fall seasons. Some of these are directional, while others are occasioned by the urge to seek food or suitable hibernating or winter quarters. It is generally believed that many insects regularly winter in Mexico and migrate northward during the spring and summer, their progeny returning home again late in the summer or in the fall.

Fresh-water Insects.—Although insects are mainly creatures of the land, there are many that have adapted themselves in varying degrees to an aquatic and semiaquatic environment. In this connection it is well to point out that insects have accommodated themselves almost exclusively to fresh water, while the great expanses of salty oceans and bays are much less populated with insect life. Many insects pass only the immature stages in the water and spend their adulthood on land or in flight.

The most primitive of these insects are the springtails of the order Collembola, which live in very damp places. Certain species congregate on the surface of snow and water. The common springtail, *Xenylla maritima* Tullb., lives on seashores; whereas the marsh springtail, *Isotoma palustris* (Müller), occurs under wet leaves and mosses and appears in great numbers on the surfaces of fresh-water pools.

Of all aquatic insects, the mayflies are the most common. The females are very prolific, and the hatching of the eggs and subsequent development are rapid; the whole life cycle may be completed in six weeks. The active immature stages, called naiads, live in fresh-water streams, lakes, and ponds. The fragile, winged, short-lived adults often emerge from large bodies of water, like the Great Lakes and rivers of North America, in such enormous numbers that their dead bodies are cast ashore in great windrows. The living forms are important as food for game fish, birds, and other animals. These insects are abundant in North America east of the Rocky Mountains; they also occur in great numbers throughout the temperate and tropical areas of the world. The order is a relatively small one consisting of about 150 described genera and 1,270 species. The common *Hexagenia bilineata* not only is widely distributed in North America but is also neotropical and African. The virgin mayfly, *Polymitarcys*

virgo (Olivier) 1791, is the commonest species in Europe. The Papuan mayfly, *Plethogenesia papuana* (Eaton), which occurs in countless numbers on the Fly River, New Guinea, is believed to reproduce only in the subimago stage. The adults of all species are such attractive baits that fishermen have devised artificial imitations called drakes or drakeflies.

The so-called water scorpions are slender bugs with long respiratory filaments. They swim awkwardly on the surface of the water but are more skillful on the bottom or crawling on submerged water plants. They are predaceous on other more helpless insects. *Nepa apiculata* Uhler and *Ranatra americana* Montandon are the commonest North American species.

The giant water bugs of the family Belostomatidae are poor and erratic swimmers. These, the largest of American insects, might well be called the demons of fresh-water ponds, lakes, and brooks where they feed upon living aquatic insects, snails, tadpoles, and the young of many other aquatic animals. They deposit their eggs on floating pieces of wood, leaves, and in some species on the backs of the males. The adults fly only on warm summer evenings, and from their habit of accumulating around lights in towns and cities situated near bodies of fresh water they are frequently referred to as electric-light bugs. Common throughout North America is *Lethocerus americanus* (Leidy). The tropical *L. indicus* Stål, a large species attaining a length of four inches, occurs from China and India southward to northern Australia. The largest species appears to be the South American *L. grande* (Dimmock) which is four and one-half or more inches in length.

Another family, the back swimmers (Notonectidae), are much smaller insects, being scarcely more than one-half inch in length. They are peculiar in that they swim back downward, using their oarlike hind legs to propel themselves rapidly through the water. Closely related to them are the water boatmen, which are somewhat similar in action and appearance. Their eggs are attached to water plants. They live in either brackish or fresh water, which they often leave on warm summer nights to swarm around electric lights. The Australian genus, *Micronecta*, lives in sponges. The so-called European water cricket, *Corixa geoffroyi* Leach, is one of the largest species, attaining 15 millimeters in length; it occurs also in North Africa and central Asia. The Mexican species of the genus *Arctocorixa* is so abundant in the warm fresh waters of that country that their eggs may be dried by the ton and used as food for domestic poultry and fish.

Sialids and corydalids (order Megaloptera), also called alderflies, humpbackedflies, orlflies, dobsonflies, and fishflies, are fresh-water insects, the larvae of which are choice fish bait for country lads in the Middle and Eastern states. The larvae of the large dobsonflies are especially attractive to bass and trout.

The caddisflies of the order Trichoptera form an important diet of game fishes and are therefore beneficial. Some 3,600 species have been described. *Neuronia semifasciata* Say, the largest North American species, lives in bogs and swamps of the eastern United States. The larvae of caddisflies, called caddisworms, live within self-spun cases which are frequently decorated with bits of wood, leaves, small stones, and other debris. At rest the larvae are completely hidden within their

cases; when they are crawling about, only their heads and legs are exposed, and these may be suddenly withdrawn into the cases when danger threatens. Some species living in swift mountain streams construct bags or nets to trap their food. *Chimarra aterrima* Hagen of eastern North America builds silken nets over stones; others spin trumpet-shaped catching nets. Food caught in these devices consists chiefly of algae, diatoms, and other plant life; many species are predaceous on aquatic insects and other small animal life. Pupation occurs in the case, and the adults emerge in the water and escape into the air. The adults are winged and look somewhat like certain moths. Adults of the Australian and New Zealand snowflake caddisflies of the genus *Smicridea* are white, and in flight resemble a snowstorm.

In the genus *Amphizoa* of the order Coleoptera there are only four species of American water beetles living in fresh-water streams along the Pacific coast. The diving beetles of the family Dytiscidae constitute a very large cosmopolitan group of predaceous beetles. The larvae feed upon other small animal life of fresh water. These beetles have dull to brilliant colors and vary in size from small to large, *Dytiscus latissimus* Linn., 36 to 44 millimeters long, being the largest European species. The family consists of some 90 genera and over 2,000 species.

The small whirligig or gyrenid beetles which gyrate on the surface of still waters are widely distributed. They vary in size from the small European *Gyrinus minutus* Fab., 3.5 to 4.5 millimeters, to *Macrogyrus* of Australia, 12 to 15 millimeters in length.

The water scavenger beetles, or the Hydrophilidae, consist of 1,700 species which are mostly tropical. The largest European species is the great black water beetle, *Hydrous piceus* Linn., 35 to 50 millimeters; the largest in North America is *H. triangularis* (Say), 23 to 37 millimeters in length.

The European turnip mud beetle, *Helophorus rufipes* Bosc, is a land form feeding on roots of turnips in England.

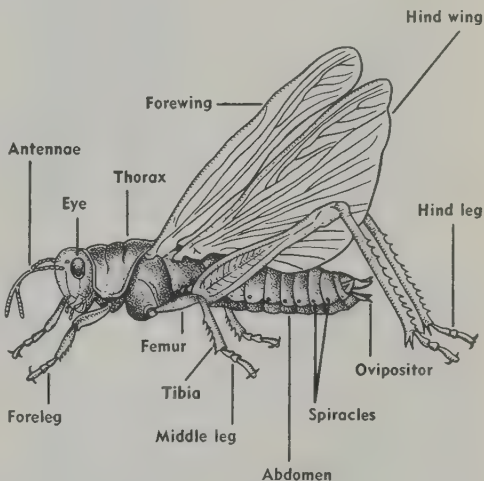
Marine and Brackish Water Insects.—It is rather remarkable that insects, so numerous on land and in fresh water, are so poorly adapted to the brackish and salt waters of the earth. Nevertheless, in the brackish waters of land areas there are a goodly number of representatives, and along the seashores and even on floating seaweeds in mid-ocean insects do occur. Many groups of insects, especially scavengers, inhabit the beaches. Among these the maritime earwig, *Anisolabis marina* (Gene), and other related species forage along the seashores of North America and the Old World. Flies, beetles, and Collembola are among other insects inhabiting the shores. The wingless marine water striders like *Halobates micans* Esch. live on the surfaces of deep lagoons on the open oceans of Micronesia; others live on beds of seaweeds in the Sargasso Sea miles from land. *Hatovelis* occurs in small sheltered coves; the minute males ride on the backs of the females to keep from being separated. The marine midge, *Pontomyia natans*, lives in the lagoons of Samoa. The females are larviform, and the males swim with the wings. Another strictly marine insect is the Australian and New Zealand caddisfly, *Philanisus plebejus* Walker, the larvae of which inhabit rocky ocean pools along the coasts. Non-biting salt-water gnats are *Clunio murinus* Haliday, *Psammothomyia pectinata* Derby, *Thalas-*

somyia frauenfeldi Schiner of Europe, and the Japanese *Clunio pacificus* Edwards, which is only 2 millimeters long. The males are winged, and females are apterous. Another gnat, *Belgica antarctica* Jacobs, lives in the sea around Patagonia.

The brackish and salt-water mosquitoes are noted for their great numbers and pestiferousness to humans as well as to domesticated and wild animals. Certain species breed along the seashores, and others in alkali lakes and ponds where the salt content is not too great. Many anopheline mosquitoes, the world over, breed in water with a salt content as high as 3 per cent; they are not only vicious biters but often vectors of malaria, and may be classed among man's most noxious enemies. No less than 85 species and varieties of these mosquitoes are known. Other pestiferous salt-marsh mosquitoes belong to the genus *Aedes*, of which there are six very important vectors of malaria.

STRUCTURE AND MODE OF LIFE

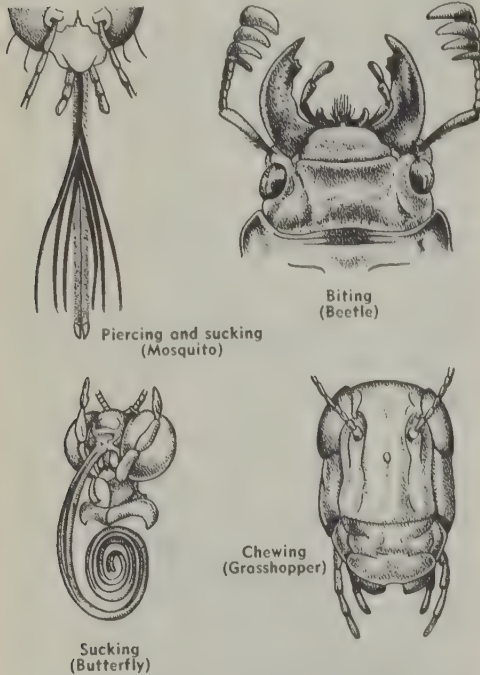
Anatomy.—Insects are among nature's greatest anatomical achievements and are admirably equipped to hold a fair place in her economy. They are small and capable of reproducing in tremendous quantities. In versatility and numbers they excel all other animals. Their geological history indicates their very early presence in Siberian fossils and in North America.



Basic insect body plan.

The exoskeleton or outer cellular layer is an elastic, chitinous cuticle, which is regularly shed to permit developmental growth. The head capsule, made up of sclerites which are strongly cemented together, supports the antennae, the mouth parts, three ocelli (simple eyes), and the two large compound eyes, each composed of many small facets. In some insects, such as aphids, leafhoppers, coccids, cicadas, and their close relatives, the mouth parts are fused together to form a piercing and sucking rostrum, whereas in other groups they are adapted for biting and chewing. The thorax joins the head and abdomen. It is composed of three segments: the prothorax, mesothorax, and the metathorax. These are in

turn made up of sclerites, including the scutellum. The thorax has great muscular strength and supports the legs and the one or two pairs of wings; it is attached at the rear to the abdomen, which is often the largest portion of the adult body. It is composed of 10 or 11 segments, and contains the genital organs, the ovipositor or egg-laying organ, and other specialized parts. There are innumerable variations in connection with all of these organs.



Types of insect mouths.

Inside the insect's body are far more complicated organs, most of which are beyond the scope of this account. Suffice it to call attention to some remarkable ones. Of these, the auditory organs are situated on the abdomen of some, on the forelegs of locusts, and on the antennae of a great many other insects. The nervous system consists of a double ventral cord connected also by a double nerve cord with a connecting ganglia in each segment. Nerves reach all other parts of the body and its appendages. The muscular system consists of large fiber bundles of striated muscles attached to the body walls and the various appendages. The digestive system includes the fore and hind guts, gullet, crop, gizzard, and tubular stomach, which empties into the coiled intestine, and is voided through the rectum. There are also secretory organs and the paired Malpighian tubules which are chiefly urinary in function.

Circulatory System.—Insects, for the most part, have an open circulatory system; the blood fills the body cavity, bathes all tissues freely, collects beneficial and waste materials from the digestive system, glands, and other organs, and distributes the waste to the Malpighian tubules. The heart or dorsal tube is the pulsating organ;

that part of the heart passing through the thorax is known as the aorta. The blood of most insects is without hemoglobin and therefore appears whitish or yellowish in color. It is remarkable that hemoglobin does occur in the blood gills of the larvae of certain midges, gnats, caddisflies, caterpillars, and beetles.

Respiration.—Most insects breathe through a closed system of elastic branching tracheae and tracheoles, somewhat after the pattern of the closed system of mammals: the system functions like the arteries, veins, and capillaries of higher animals, only air and not blood aerates the tissues directly. Larger air sacs of varying sizes, which are formed by dilations of the tracheae, occur in grasshoppers, flies, and bees. The entire abdomen of the cicadas constitutes an air reservoir. The openings or spiracles or stigmata of this system occur along the sides of the body and usually consist of 10 pairs—two pairs on the thorax and eight on the abdomen. Most aquatic insects breathe by means of tracheal gills, but certain ones carry an air supply with them under water.

Nervous System.—The principal organs of the nervous system are located ventrally along the median line and consist of a series of ganglia or nerve centers connected by a double nerve cord and radiating nerves and nerve fibers to all parts of the body. The brain or supraoesophageal ganglion is located in the head above the oesophagus and innervates the antennae, eyes, and labrum. The mushroom bodies, developed in ants and bees, are groups of cells whose fibers unite to form stalked nerve structures in the protocerebrum, or the larger part of the brain which controls the eyes and ocelli. The suboesophageal ganglion, situated below the oesophagus, innervates the mouth parts except the labrum. Two cords, the *crura cerebri*, one on each side of the oesophagus, connect the brain and the suboesophageal ganglion. The thoracic ganglia may consist of three separate nerve centers located in the different segments or they may be fused into one or two ganglia in some insects. The abdominal ganglia are normally distributed, one in each segment, or they may be fused into fewer centers. Wherever a ganglion is located in a segment, it becomes the nerve center of that particular part of the body.

Sense Organs.—Sight is present in nearly all insects excepting a few subterranean and cave-dwelling forms. Certain immature forms have only a pair of simple eyes, whereas the great majority of adult insects have two large compound eyes—made up of a large number of facets—and three simple eyes or ocelli, which are arranged in a triangle on the vertex and frons of the head. Organs of taste and smell are highly developed in all forms, and many insects rely upon these senses to find their food.

Metamorphosis.—One of the really remarkable phenomena of the animal world is the metamorphosis or growth and development of insects from egg to adult. Metamorphosis may be of the *primitive, simple, or complex* type.

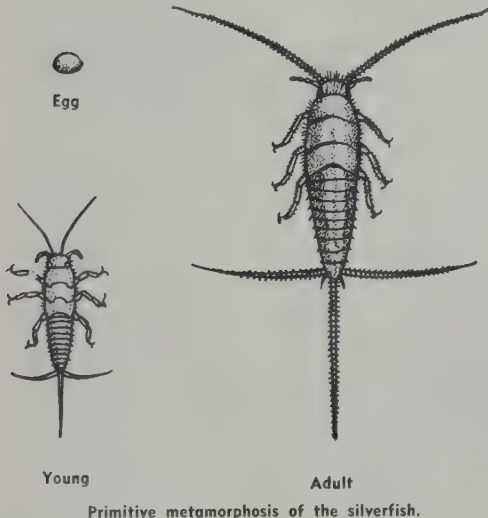
Primitive metamorphosis is an apterous condition in which there are no distinct changes evident, except in size and sometimes in coloration. Examples: the minute proturans, silver fish moths or slickers, and the snowfleas.

Simple metamorphosis is a type in which certain organs, such as gills of aquatic larvae or naiads, are evident. Examples: most of the aquatic insects, grasshoppers, dragonflies, mayflies.

Complex metamorphosis is a type in which the larval stage is altogether different in appearance from the adult. Included are the scorpionflies, raphidids, lacewings, flies, fleas, beetles and weevils, butterflies and moths, ants, bees, wasps, sawflies, horntails, gallflies, and the very large group of parasitic wasps.

Eggs.—The eggs are not greatly different from those of other invertebrate animals. All are furnished with a polar micropyle, consisting of one or more microscopic openings through which the male sperm enters and fertilization is accomplished. Eggs of many insects also have an operculum, a lid or cap by means of which the young emerge. The eggs are necessarily small, varying from 0.1 to 6 millimeters or perhaps a little larger. They may be beautifully colored and marvelously sculptured, and are deposited singly or in clusters; a single female may lay from a few to a thousand. Termites, ants, and bees appear to be the most prolific. The eggs may be laid in a cement matrix, in a capsule, or may be

object preparatory to development into the pupal or chrysalis stage. A great variety of other methods are employed in which to pass the resting and reorganization condition: in wax cells, silken and hair cocoons, cases, and nests in wood and

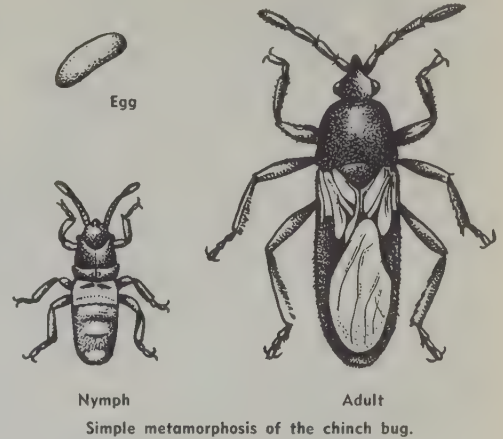


Primitive metamorphosis of the silverfish.

covered with an exudate together with scales from the female body. Water insects may also deposit them in gelatinous masses or in strings.

Larva.—This term is usually applied to the first stage of those higher insects that have complete metamorphosis. They are quite different from the adults and in many cases bear no resemblances to them whatsoever. Some of them are better known under such names as ant lions, bagworms, cankerworms, caseworms, caterpillars, flat-headed borers, grubs, leaf rollers, leather-jackets, loopers, maggots, silkworms, slugs, skipper, spanworms, tomato worms, warbles, white grubs, waxworms, wireworms, wrigglers, and others. There are many types of these larvae which are frequently referred to as worms, but it is not possible to describe them by their technical designations. Among the plant-eating forms this stage is the most destructive to vegetation, whereas with respect to health the adults are the "biters" and carriers of animal diseases.

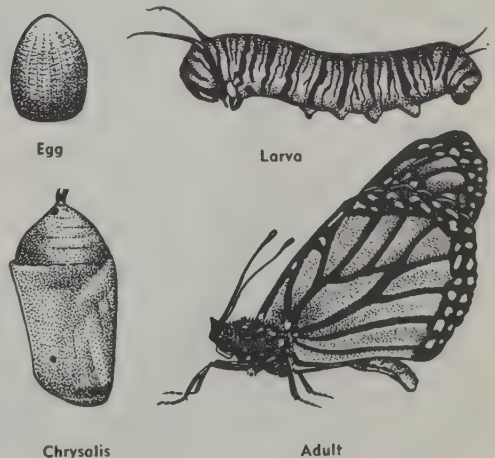
When full grown, the larvae of most butterflies and many other insects usually fasten themselves at the posterior end to a twig or other



Simple metamorphosis of the chinch bug.

soil. The resting and reorganization period is a vulnerable one for insects; ordinarily they are defenseless at this time, and so they have been enabled by nature to camouflage themselves and to seek protective burrows and other concealment. That these devices have been successful is indicated by the fact that insects are the most numerous and varied of all the higher types of animal life.

Protective Devices.—Insects are often referred to as hexapods because in the adult condi-



Complex metamorphosis of the Monarch butterfly.

tion they possess three pairs of legs. This allows for the loss of one or more legs, all of which may be regenerated to some extent. Wings, antennae, and cerci are also deciduous appendages. The insect body, or exoskeleton, is hard, tough, light, and elastic, capable of renewal, and resistant to

corrosive chemicals. It is further protected by hairs, scales, spines, rugosities, and the wings, which are folded like a roof when the insect is not in flight. Insects have also developed protective and warning colorations, and use other devices of mimicry. They may be shielded somewhat by bizarre color patterns, by their grotesque forms, and by noises they can make—loud stridulations, such as buzzing and drumming. Safety may also be assured by alertness and keen ability to perceive motion. Among other protective devices are biting, jumping, snapping, death-feigning, flight, and secretive nocturnal and seasonal habits. For use against their enemies insects have a variety of weapons, such as excretions of protective waxes, resins, and offensive and poisonous glandular fluids and gases. Sticky and volatile fluids are employed for carrying on offensive warfare. Stings are effectively used by bees and wasps. Protection during the various stages of insect development (eggs, larvae, pupae, and adult) is provided by specially constructed living quarters, as in the cases of caddisfly larvae, certain caterpillars, the paper nests made by wasps in which to rear their young, as well as webs, cocoons, spittle, and galls.

Mimicry.—One of the most remarkable phenomena among insects is mimicry—the resemblance of one insect to quite different, unrelated species. Some classical examples are the close similarity of the viceroy butterfly to the monarch butterfly, the drone fly to the honeybee, certain robber flies to bumblebees. The small beetle, *Casnonia*, is very like the ants in whose nests it associates. Other examples are to be found in a great many widely separated groups of insects.

Luminosity.—Many insects are able to generate light. Marvelous are the fireflies of the family Lampyridae, which are beetles, and a few other insects belonging to the families Lycidae, Phengodidae, Drilidae, Cantharidae, and the springtails of the genera *Anurida*, *Achorutes*, and *Onychiurus*. The North Carolina fungus gnat, *Platyrura fultoni*, lives in wet dark places and glows at both ends. The adults of the European midge, *Chironomus plumosus*, are luminous. Most remarkable is the New Zealand glowworm, the larva of the mycetophilid fungus gnat, *Arachnocampa luminosa* Skuse, which lives in the famous Waitomo Caves, New Zealand. The small, slender larvae spin webs upon which they live in wet crevices and on the surfaces of the moist rock walls. They move with agility when disturbed. The colonies are sufficient to cover large surfaces, and when there is complete stillness the whole cave begins to glow with a mystic golden light like that of a starry sky. The light is steady rather than flashing. Other colonies of great size occur in New South Wales, Australia.

Diseases of Insects.—Like all other animals insects are subject to diseases which play a large part in keeping them in check. The most important are those caused by bacteria and fungi. These important checks aid man in his struggle with these small relentless competitors.

Social Insects.—There is instinctive cooperation among the so-called social insects, such as the ants, bees, and wasps, which, in all cases, is based upon a caste system. This system is the result of a hereditary condition in which there are nonsexual or aborted individuals incapable of reproduction. The sterile or aborted insects are bound to servitude and do all or most of the work and provide the food for the colony.

Termites are a most highly specialized group of social insects. They stem from the prehistoric age and are among the oldest living inhabitants of the earth. They are remarkable because of their highly organized system of castes, which is patterned somewhat after that of the ants. They have rather soft bodies; those individuals that are confined to the darkness of their nests are pale, whereas the migrating and winged aerial forms are usually brown and black. Termites vary in size from very small workers, which are only a few millimeters, to others an inch or more in length. They are rarely encountered except during their mating flights when they may swarm in great numbers from the ground or from dead wood, frequently after the first rains in the temperate regions. They get the name "white ants" from their general resemblance to the common ants, which are quite distantly related to them. Their very complicated caste system, not fully understood even by experts, consists of *reproductives*, winged and wingless, and *aborted forms*, workers and soldiers. The reproductives, the sexual males and females, are the life of the colony, responsible for maintaining it and founding new colonies.

A colony consists of a royal pair, king and queen, which are the parents. The males are extremely small, whereas the queens may be as large as a man's thumb. After mating, the queen begins to lay eggs, producing thousands of them annually over a period of from 5 to 15 or more years. Other individuals of the colony are the winged and wingless termites, the apterous workers, as well as the large-headed soldiers which defend the nest against the attacks of other insects. Soldiers of the genus *Nasutitermes* have heads prolonged into a snout employed to smear a sticky secretion upon their enemies.

Termite nests are either subterranean or aerial, and the great termite mounds are among the most remarkable objects of nature. They occur mostly in the warmer tropical and subtropical regions of Australia and Africa. None of them seem to occur in the Western Hemisphere, although common termites are abundant in that half of the world. In the temperate regions of North America, termites are chiefly subterranean in habit.

Termites are without doubt the most prolific of all insects. An investigation of their reproductive capacity was made by the Councils of Science and Industrial Research of Australia in 1938. Selecting a small mound one and one-half feet high and four feet wide at the base, the council assembled the following facts about the Australian termite, *Eutermes triodiae* (*Nasutitermes exitiosus*):

Total population	1,800,000
Workers	1,560,000
Soldiers	200,000
Young	40,000
Humidity	above 95 per cent
Temperature	relatively high

Termites feed upon dead and dying vegetation, which is converted into foods available for plants; they thus have a real place in the general economy of nature. They are troublesome and destructive to man because they destroy wooden buildings, fences, bridges, and all other plant products.

INSECTS AND MAN

Insect Biters.—In addition to mosquitoes, which are among the greatest tormentors of the human race and its domestic animals, many other



INSECTS

(1) *Spiloniia fusca*, a wasp-like hover fly. (2) *Musca domestica*, the common housefly. (3) *Dolichovespula maculata*, the white-faced hornet. (4) *Cynomya mortuorum*, a bluebottle fly. (5) *Urocerus flavicornis*, a horntail. (6) *Eulonchus smaragdinus*, a small-headed fly. (7) *Ceratogaster fasciata*, an ichneumon fly. (8) *Cuterebra buccata*, a large botfly. (9) *Doros aequalis*, a wasp-like hover fly. (10) *Lampria Mexicana*, a robber fly. (11) *Dasymutilla klugii*, a velvet ant. (12) *Bombus huntii*, a bumblebee.



Conchuela



Praying mantis, feeding on grasshopper



Spined predacious bug



Girdled cicada



Cicada



Grasshopper



Black pine sawyer



Oil beetle

insects add to man's misery. Buffalo gnats, black flies, and turkey gnats belonging to the family Simuliidae are among the most annoying and persistent. The larvae live in fresh-water streams, and the adults continually harass fishermen, vacationers, and domestic animals. An African species transmits a filarial disease to man. The most notorious American species are the Adirondack black fly and the white-stocked black fly in the eastern United States, the turkey gnat in the Rocky Mountain region, and many others. Biting midges, punkies, no-see-ums, and sand flies belong to another family of tormentors of all higher animals, especially man, throughout the world. They are often so small as to be scarcely discernible, but their bites are sharp and usually very painful. The larvae live in fresh and brackish water. Some tropical species transmit filariasis to man. Sucking lice of the order Anoplura and fleas belonging to the order Siphonaptera, both of which in years past were the most intimate and annoying pests of the human race, have almost entirely disappeared as a result of sanitation and the discovery and intelligent use of new and very effective insecticides.

Insects and Human Diseases (Medical Entomology).—A considerable number of insects are carriers and vectors of human diseases. In ancient times, before man had knowledge of either the diseases or the vectors, he became the victim of many terrible scourges that took millions of lives. Of these early maladies, black death or bubonic plague was the most destructive. The great plague of 1665 in London killed about 70,000 out of a population of about 450,000. The microscopic germ *Pasteurella*, causing this terrible disease, developed in fleas which carried the plague to humans. Rats, too, contributed to the transmission of the disease as the host carriers of the fleas. It is comforting to know that the effective destruction of rats and fleas has practically eliminated this scourge from civilization.

Other important insects bearing diseases that are associated with man are the tsetse flies belonging to the genus *Glossina*, of which there are some 21 species and a considerable number of varieties. All occur in tropical, subtropical, and equatorial Africa, excepting only a single species reported in Arabia. Of these flies, the *Glossina fusca* (Walker 1849), consisting of 10 species and several varieties, plays a minor role in the transmission of African sleeping sickness, a disease of high mortality caused by *Trypanosoma gambiense* Dutton. Another more important group, the *Glossina palpalis* (Robineau-Desvoidy 1830), which contains seven species and a number of varieties, transmits Gambian sleeping sickness produced by *T. gambiense* to man and by *T. uni-forme* Bruce to sheep and goats; souma, a disease of cattle and horses, is caused by *T. vivax* Ziemann. The *Glossina morsitans* Westwood 1850 group, with six species and two varieties, is the most important and serious vector of the trypanosomes causing Rhodesian sleeping sickness; *T. brucei* Plimmer and Bradford causes nagana of cattle, and *T. suis* Ochmann of swine.

Perhaps the commonest of mankind's most wretched diseases is malaria. It is worldwide in distribution and has caused much misery, but it is rapidly being exterminated throughout most of the world. The disease appears to be as old as the human race, but it was not until 1897 that the Englishman, Sir Ronald Ross, in India, discovered that mosquitoes were the carriers and vectors of

malaria. Later the Italian zoologist, Giovanni Battista Grassi, found that only mosquitoes of the genus *Anopheles* were capable of transmitting the disease. Treatments for malaria with cinchona bark, the source of quinine, were known in Peru by 1638 or earlier, when the bark may have been used to cure the condesa de Chinchón of the fever. The bark was introduced into Europe in 1640 and subsequently given the scientific name *Cinchona officinalis* by Linnaeus. A great amount of exploratory work and research has been done and continues to the present time in order to secure and produce the best possible species and hybrids of cinchona for making the finest types of medicinal quinine.

Yellow fever, another very serious tropical disease, was also a terrible scourge to the human race until the discovery that it and dengue fever were transmitted by the mosquito *Aedes aegyptii* (Linn.). Insects are responsible also for the transmission of many other serious diseases of man and his domesticated animals.

Insects as Food for Man.—Although insects are among the commonest and most abundant forms of animal life associated with the human race, they are the least known and the most grossly misunderstood by civilized peoples. Aboriginal races, however, appreciated the many values of insects and ate a great many of them as well as insect products, such as honey and honeydew. Ingrained in most of us is the fallacious belief that insects, such as aphids, caterpillars, and fragments of all other kinds are filth. As a matter of fact, these animals—minute, delicate, soft-bodied—have throughout the ages been commonly eaten by human beings and other animals along with vegetables and fruits without ill effects and in most cases no doubt to the advantage of the consumer.

Aphids and other small species, which are common on nearly all vegetable crops, caused great concern and much financial loss to growers and canners of vegetables and fruits because of the virtual impossibility of producing these crops without their being infested by many small and obscure insects; crops are thus subject to rejection or confiscation after canning and other processing, because of insect contamination. Even though repeated applications of insecticides are made and the harvested crop is thoroughly washed and otherwise treated to eliminate the insects, it is practically impossible to remove all invisible parts from the canned or dried product. It would seem to be far safer to eat a few harmless insects than to eat fresh and canned vegetables which have been even slightly contaminated with poisons used to eliminate the insects. Many species of insects have been consumed by all races, past and present. Examination of historical documents, including the Bible and numerous authorities on ancestral man, reveals the important dietary use of insects. Anthropologists tell us that three fourths of the food of certain West coast American Indians was vegetable and one fourth animal, the latter consisting chiefly of insects.

The most generally available and preferred insects the world over were locusts, or migratory grasshoppers. They often appeared unexpectedly from unknown lands in countless numbers, and, although in most cases they destroyed the farmers' crops, they in turn became food for hungry human beings. Locusts were a regular article of diet of savage and civilized peoples in Asia, Africa, North and South America, Australia, and certain

of the Pacific Islands. Because grasshoppers are quite large and easily captured, they are readily available with little effort. Grasshoppers, bees, ants, and other insects, as well as certain insect eggs, have been purchased in food stores of many United States and Canadian cities.

In China and other parts of Asia the vast populations living on the banks and in houseboats along the lower reaches of the great rivers are favored during certain parts of the year with an inexhaustible supply of the large predaceous water beetles. They are consumed fresh, cooked, dried, pulverized in soups, and in other ways. Species eaten at the present time by the Asiatics include *Hydrous pallidipalpis* MacLeay of south China and the Indochina peninsula; *Cybister bengalensis* Aube; *C. guerini* Aube; *C. japonicus* Sharp; *C. limbatus* Fabricius; *C. sugillatus* Erichson; and *C. tripunctatus* Olivier (Hoffman 1947). In China no less than 50 species of insects are not only consumed in the daily diet but make up a considerable part of the total food intake. Some species are also considered to have unquestionable medicinal value.

The water bug, known as the giant fish killer, *Lethocerus indicus* Stål, a preferred dietary item of tropical China, India, and Australia, attains a length of four inches. A similar water bug of South America, *L. grande* (Dimmock), is even larger, measuring up to four and one half inches; in North America *L. americanus* (Leidy), the most common species, was and is still eaten by man.

In Mexico the water bugs occur in tremendous quantities in Lake Texcoco and Lake Chalco near Mexico City, especially the Aztec water boatman (*Krizousacorxia axteca* Jaczewski), the Mexican water boatman (*K. femorata* Guérin), and the commercial boatman (*Corisella mercenaria* Say), together with the Texcoco back swimmer, *Notonecta unifasciata* Guérin (Ancona, 1933), and their eggs and young. They have been used for human food from ancient times and are still so used in Mexico. They are also exported by the ton to other parts of the world, where they are sold for fish, turtle, and bird food. The eggs of the water bugs are made into a sort of caviar, and the water bugs themselves are sold in some places for chicken feed. In Mexico City one of the delicacies often praised by visiting tourists is *los gusanitos de maguey*. These are large white caterpillars that mine the fleshy leaves of various species of *Agave*. They are often offered for sale along with pulque. These caterpillars, or maguey worms, are usually fried; they are also canned and sold in grocery stores. The adult is a skipper butterfly scientifically known as *Acentrocne me hesperiaris* Kirby (*Aegiale kollari* Felder, *Teria agavis* Blasques).

In California, the Indians of the Mono Lake region gathered and ate the pupae of the ephydrid fly, *Ephydra hians* Say, which were washed up in windrows on the shores of Mono Lake by windstorms.

The large fat grubs and also the pupae and adults of many beetles have been consumed fresh, dried, or parched. The most striking examples are the palm rhinoceros beetle, *Oryctes rhinoceros* (Linn.), of tropical Asia; the American sugarcane beetle, or grou-grou, *Rhynchophorus palmorum* (Linn.), and the Hercules beetle, *Dynastes hercules* (Linn.), of the tropical Americas; and the atlas beetle, *Chalcosoma atlas* (Linn.), of tropical Africa.

Of the caterpillars of butterflies and moths, many kinds were eaten either fresh, toasted, dried, boiled, or roasted. Hairy tent caterpillars of North America, especially California, which were abundant in the spring, were singed to remove the hairs and roasted before the fire by Indians. The large larvae and pupae of the pine pandora moth, *Coloradia pandora* Blake, were dried and consumed alone or mixed with corn meal by the aborigines of western North America.

Termites have been an important food wherever they occur in tropical and temperate regions. All castes and states of them were eaten, mostly alive. The large queens of the mound-building species in tropical Africa, Australia, and elsewhere were considered a very great delicacy.

Various species of lice infesting the bodies of humans were eaten by all aboriginal races. They were devoured not only because they had a pleasant nutty flavor but also as a ritual among certain tribes.

Many insects furnished honeydew, the much appreciated manna of the Israelites, and also honey, the most important sweet available up to about 1420, when cane sugar became a commercial product. The honeybee was cultivated by the ancient Egyptians and Chinese, and with the beginning of recorded history, this remarkable insect appears in the literature of all the important civilizations of the world. Many strains have been developed in different countries in the African-Eurasian continental areas.

Insect Control.—The control of food-destroying and disease-bearing insects is necessary to protect the health, food supply, and other necessities of the human race. As populations increase, crop protection becomes more important. Scientists of all professions have joined the entomologists in the gigantic task of supplying the information necessary to guarantee adequate protection. The first effective insecticides were not developed until the mid-19th century, and since that time great progress has been made in the discovery and development of new and remarkably effective insecticides. The greatest concern in the use of insecticides is to overcome the remarkable faculty that insects have of readily developing resistance to practically all of the most effective and powerful chemicals thus far used.

The so-called biological control method appears to be a very important aid in the solution of this problem. This method employs the selection and use of certain insects that naturally parasitize and devour other injurious insects. It was first demonstrated in the control of the cottony cushion scale, which became a very serious pest on citrus trees in California, by the introduction of the vedalia, a ladybird beetle that was naturally predaceous on the cottony cushion scale in Australia. This paved the way for more experiments along this line and to the development of the modern science of biological control.

Insects of Commercial Value to Man.—

The domestic honeybee or hive bee is certainly one of man's oldest and most valuable domesticated animals. Its association with man goes back beyond dated history. It is also the most socialized insect. The adult members of the hive are divided into three castes: the fertile queen, the mother of the colony; workers, or aborted or infertile females; and the drones or fertile males. A hive or colony usually consists of from 20,000 to 50,000 individuals. The most important domestic races are the Italian, which are the most industrious;

the Caucasian and the Carniolan, which are the gentlest; and the German, which are the most hostile, but which respond to smoking. The benefits derived from honeybees are very important, the greatest being the cross-pollination of food plants and other cultivated and wild plants and the production of honey and beeswax.

During past centuries, silkworms provided the human race with the most luxurious clothing. The Chinese silkworm, whose history is obscure, has become so completely domesticated that it can no longer live without the care of man. Its important economic status is now being jeopardized by the manufacture of synthetic cloth, which may eventually result in the extermination of this valuable insect.

The cochineal dyes were derived from the dried bodies of a cactus-infesting scale insect of Mexico. The dyes, treated with mordants, produced brilliant red hues. The discovery and perfection of aniline dyes during the latter half of the 19th century did away with the use of cochineal.

The greatest early sources of waxes were the honeybees and wild bees. Wax is used by the bees chiefly for making comb in which to store the honey necessary to carry them over during the long periods when flowers and other sources are not available. Beeswax was used in enormous quantities during the Middle Ages.

The manna of the Israelites is believed to have been produced by a coccid or scale insect, *Gossyparia mannifera* (Hardwick), which feeds on the desert *Tamarix* of Iraq and Asia Minor. The sweet excretions, now called honey, accumulated under the plants. Because of lack of rain these accumulations stratified and solidified. The sugar was recovered by a process of evaporation, involving the soaking of these deposits in water. Honey is still so collected by Arabs and others.

See also COLORATION IN ANIMALS; ENTOMOLOGY AND INSECT CLASSIFICATION; INSECTICIDES; METAMORPHOSIS IN ANIMALS; MIMICRY IN ANIMALS; and separate articles on individual insects.

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INSIDE OF THE CUP, The, a novel by Winston Churchill, the American novelist, published in 1913. This strong polemic on the purpose and value of religion in the modern world takes its theme from the words of Jesus: "Woe unto you, scribes and Pharisees, hypocrites! for ye make clean the outside of the cup and of the platter, but within they are full of extortion and excess . . . cleanse first that which is within the cup and platter. . . ." (Matthew 23: 25-26).

John Hodder, a young clergyman from New England, called as rector to St. John's, a fashionable church in a large Midwestern city, grows increasingly dissatisfied over the work his church is doing—and failing to do—in meeting the

spiritual needs of the community. After a prolonged and painful struggle with his conscience, during which he is forcibly confronted with the evils of irresponsible wealth and financial power, he arrives at what he believes to be a more democratic, less dogmatic, Christianity—a church not for the privileged only but for all who seek to better their lives. He expounds his new views in a sermon branded as heretical, radical, and dangerous by most of his influential parishioners—among them Eldon Parr, a banker and stock manipulator, the embodiment of all Hodder was inveighing against.

The rector refuses to resign, and the issue is joined between them. Parr cannot prevent his daughter from marrying the minister; but, remaining unregenerate to the end, he can, and does, disinherit her and withdraws his support from St. John's. Meantime, many who felt they had lost all faith find their way back to a church which has been brought closer to their needs and aspirations.

INSIGNIA OF RANK, Armed Forces, in-sig-ni-à. Just as distinctive uniforms set apart the military man from the civilian, and distinguish the members of the armed forces of one nation from those of others, so insignia of rank denominate the various grades within the military, naval, and air forces of each nation. Officers, warrant officers, and noncommissioned officers, charged with varying degrees of authority, wear distinctive insignia for each grade, so that they may be readily identified by subordinates as well as by superiors.

Properly, the word *insignia* is the plural of *insigne*, but in common military usage *insignia* is employed as both singular and plural.

Insignia of military rank is a recent development in the long history of warfare. Prior to and during the Middle Ages military commanders came from the aristocracy and were easily identified by their heraldic trappings. But by the 16th century the professional army, either national or mercenary, was replacing the feudal levies, and the leaders were not necessarily nobles of the realm. During the 17th century the household troops of Louis XIV of France were given distinctive uniforms, as was the New Model Army in England. Officers wore a much more elaborate uniform than their men, but it was not until late in the 18th century that actual insignia of rank came into general use.

In the United States, the first rank insignia was devised by Gen. George Washington in 1775; generals, field officers, captains, and subalterns were to wear different colored ribbons and cockades. In 1780 a system of epaulets on one or both shoulders was adopted and with it the first of the modern insignia—silver stars for general officers. The colonel's spread eagle was adopted in 1832, and within the next decade most of the rest of the present officers' insignia appeared; that of 2d lieutenant, however, remained a blank shoulder strap until the gold bar was adopted during World War I. Chevrons of noncommissioned officers, at one time worn point down (as today by the navy and air force), have undergone many changes to keep pace with the increasing specialization of the modern armed forces.

The insignia of rank and related insignia worn by the armed forces of various nations are described below.

ARGENTINA

Army.—Officers' insignia of rank is worn on shoulder straps of service and field uniforms; that of other ranks is worn on the upper sleeve. The cap device consists of the national coat of arms in a wreath, above which is a blue and white rosette.

General of Army, General of Division, and General of Brigade: On red-edged shoulder strap, crossed gold wheat sprigs below three (two, one) 12-rayed suns in gold on red disks.

Colonel, Lieutenant Colonel, and Major: On strap edged in light green, three (two, one) gold suns on disks of branch color.

Captain and First Lieutenant: Three (two) silver disks with projecting knobs.

Lieutenant: One gold and one silver disk.

Sublieutenant: One silver disk.

Senior Warrant Officer: Two thin vertical gold interwoven stripes.

Warrant Officer: One thin vertical gold stripe.

Sergeant Major and First Sergeant: Two (one) narrow above one broad horizontal gold stripe.

Sergeant: One narrow above two broad gold chevrons, point down.

First Corporal and Corporal: Two (one) narrow above one broad gold chevron.

Navy.—Officers' rank is indicated by gold stripes around the lower sleeve of blue uniforms and on shoulder boards of other uniforms, the upper stripe forming a loop. Officers of technical corps wear colored cloth between stripes. Warrant and petty officers wear insignia on the upper sleeve.

Admiral, Vice Admiral, and Rear Admiral: Three (two, one) medium above one broad stripe.

Captain and Commander: Four (three) medium stripes.

Lieutenant Commander: One narrow between two medium stripes.

Lieutenant: Two medium stripes.

Lieutenant (junior grade): One medium above one narrow stripe.

Ensign: One medium stripe.

Chief Warrant Officer: One narrow above two broad horizontal gold bars.

Warrant Officer; Petty Officer, 1st and 2d class: Three (two, one) narrow above one broad bar.

Seaman, 1st, 2d, and 3d class: Three (two, one) narrow above one broad gold chevron, point down.

Air Force.—Officers' rank is indicated by sleeve stripes and shoulder boards, as for the navy, with the upper stripe forming a lozenge and gold wings below the stripes. Titles and rank insignia of enlisted personnel are substantially the same as for the army.

Brigadier General, Brigadier Major, and Brigadier: From the top: one medium, three (two, one) narrow, and one very broad stripe.

Commodore, Vice Commodore, and Commandant: As above, with lower stripes half as broad.

Captain, First Lieutenant, and Lieutenant: Three (two, one) narrow below one medium stripe.

Ensign: One medium stripe.

BELGIUM

Army.—Officers' rank insignia is worn on

lapel tabs, the tab color indicating branch. General officers also wear rank insignia on shoulder straps; other officers wear regimental or corps devices on shoulder straps. General officers wear on caps, and on lapel tabs above rank insignia, a stylized grenade and lightning bolts; other officers wear on caps the royal crown or regimental device. Above the cap device all officers wear a yellow, black, and red rosette. Enlisted personnel wear rank insignia on the lower sleeve.

Lieutenant General, Major General, and Brigadier

General: Three (two, one) gold stars above two broad horizontal gold bars. On shoulder straps, three (two, one) gold stars.

Colonel, Lieutenant Colonel, and Major: Three (two, one) gold stars above a broad gold bar.

Captain Commandant: Three gold stars below a narrow gold bar.

Captain, Lieutenant, and Sublieutenant: Three (two, one) gold stars.

Senior Warrant Officer: One silver star below a narrow silver bar.

Warrant Officer: One silver star.

First Sergeant Major, First Sergeant, and Sergeant: Five (four, three) diagonal stripes, spaced between second and third from bottom.

Corporal and Private, 1st class: Two (one) diagonal stripes.

Navy.—Rank of officers and chief petty officers is indicated by gold stripes around the lower sleeve; of other personnel, by diagonal gold stripes on lower sleeve. Commissioned officers have a loop in upper sleeve stripe, and wear on the shoulders narrow curved gold bars parallel to the sleeve seam. The officers' cap device is the red, yellow, and black rosette within a double oak-leaf wreath, surmounted by a crown, in gold; the device for petty officers has a single wreath. Flag officers wear two rows of gold braid on cap visor; senior officers wear one row.

Commodore: One broad (two-inch) stripe, with a gold star above the loop.

Captain and Commander: Four (three) medium stripes.

Lieutenant Commander: One narrow between two medium stripes.

Lieutenant, 1st class: Two medium stripes, with a gold star inside the loop.

Lieutenant: Two medium stripes.

Lieutenant (junior grade): One medium above one narrow stripe.

Ensign: One medium stripe.

Chief Petty Officer, 1st class: Above a medium stripe, without loop, a gold crown in wreath.

Chief Petty Officer: Above a narrow stripe, a gold crown.

Petty Officer, 1st, 2d, and 3d class: Three (two, one) diagonal gold stripes.

Seaman, 1st class: One diagonal red stripe.

Air Force.—Rank of officers and warrant officer is indicated by blue stripes edged in black around the lower sleeve of the service coat and on shoulder straps of other uniforms. General officers wear the army grenade device on lapel tabs. Titles and insignia of rank of enlisted personnel are identical with those of the army. The officers' cap device is the royal coat of arms in a pair of wings encircled by a wreath, surmounted by a crown, in gold; for

other ranks, the same above a half wreath.

Lieutenant General and *Major General*: Three (two) narrow above two medium stripes.
Colonel, Lieutenant Colonel, and Major: Three (two, one) narrow above one medium stripe.
Captain Commandant: Three narrow stripes, the upper having a loop.
Captain, Lieutenant, and Sublieutenant: Three (two, one) narrow stripes.
Senior Warrant Officer: Two narrow above one broad stripe.
Warrant Officer: One broad stripe.

BRAZIL

Army.—Rank insignia of officers and warrant officers is worn on shoulder straps and on the field cap, that of enlisted personnel on the upper sleeve. The cap device consists of the five stars of the Southern Cross on blue within concentric ovals of silver, white, green, and yellow; for officers, the device is mounted in a gold wreath; for other ranks, in stylized rays.

Marshal, General of Army, General of Division, and General of Brigade: On gold strap below Southern Cross device pierced by a silver sword, five (four, three, two) silver stars.
Colonel: On plain strap, three disks, each consisting of a silver star mounting the Southern Cross superimposed on orange and gold rays.
Lieutenant Colonel: One star above two disks.
Major: Two stars above one disk.
Captain, First Lieutenant, and Second Lieutenant: Three (two, one) stars.
Warrant Officer: Hollow silver-gray diamond.
Sergeant, 1st and 2nd class: Six (five) chevrons, point up, in silver-gray except fourth from top, white.
Sergeant, 3d class and Corporal: Three (two) silver-gray chevrons.

Navy.—Officers' rank is indicated by gold stripes around the lower sleeve of blue uniforms and, for officers below captain, on shoulder boards of other uniforms. Sleeve stripes are the same as for the Argentine Navy, including loop in upper stripe. Shoulder board insignia for flag officers and captains is as follows:

Admiral: On gold shoulder board, a silver anchor above three silver stars in triangle, the upper star having on it the Southern Cross within laurel branches.
Vice Admiral and Rear Admiral: Silver anchor above three (two) plain silver stars.
Captain: On plain shoulder board, a silver anchor above four medium gold stripes.

Air Force.—Officers' rank insignia is worn on shoulder straps of service and field uniforms and on the lower sleeve of dress and full dress uniforms; that of enlisted personnel, on the upper sleeve. The cap device is a vertical sword on a pair of wings, mounted on stylized spread wings for officers and on stylized rays for warrant officers and enlisted personnel.

Air Marshal: On gold-braid shoulder strap, below a sword and wings device, one small and four larger stars of the Southern Cross.
Lieutenant Brigadier, Major Brigadier, and Air Brigadier: Four (three, two) stars.
Colonel: On plain strap below sword and wings,

two groups of three horizontal bars each, each group having a star centered.
Lieutenant Colonel: A group of two above a group of three bars.
Major: Two groups of two bars each.
Captain, First Lieutenant, and Second Lieutenant: A group of three (two, one) bars.
Warrant Officer: Centered on a horizontal bar, the Southern Cross within a diamond.
Sergeant, 1st, 2d, and 3d class; Corporal; and Private, 1st class: Five (four, three, two, one) chevrons, point down, in gull-wing form.

CANADA

Insignia of rank of personnel of all services is the same as for the armed forces of the United Kingdom (see section in this article). In the army, the word "Canada" in metal is worn on the outer edge of the service coat shoulder strap, and is embroidered on a tab just below the battle dress shoulder seam. In the navy a similar tab is worn on all uniforms, and on seamen's cap ribbons the letters "HMCS" precede the ship's name. In the air force the word "Canada" is embroidered on a black tab just below the shoulder seam for officers; the tab for other ranks bears the word "Canada" above a soaring eagle. The wings of flying personnel bear the letters "RCAF."

NATIONALIST CHINA

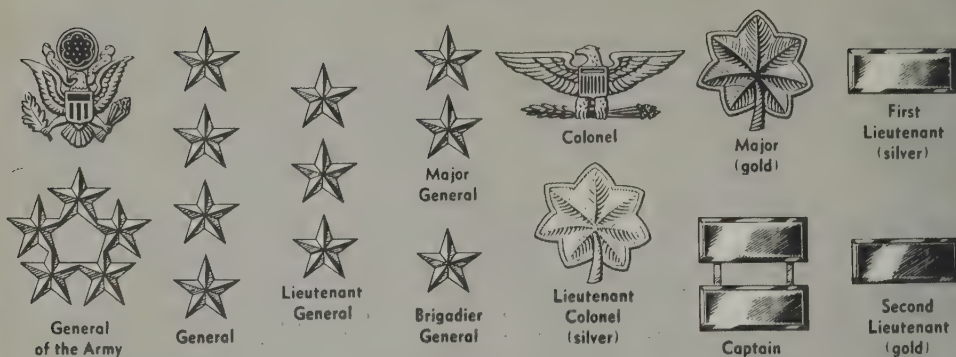
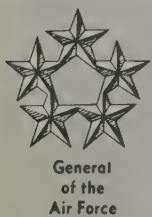
Army.—Officers' and warrant officers' rank insignia is worn on shoulder straps, branch insignia on the collar. Piping on lower sleeves is in red for general officers, yellow for field officers, and blue for company officers. Rank insignia of enlisted personnel is generally the same as for the United States Army.

Generalissimo: Five gold stars in a circle.
General of the Army, General, Lieutenant General, and Major General: Four (three, two, one) gold stars.
Colonel, Lieutenant Colonel, and Major: Three (two, one) gold plum flowers.
Captain, First Lieutenant, and Second Lieutenant: Three (two, one) silver bars.
Warrant Officer: One silver square.

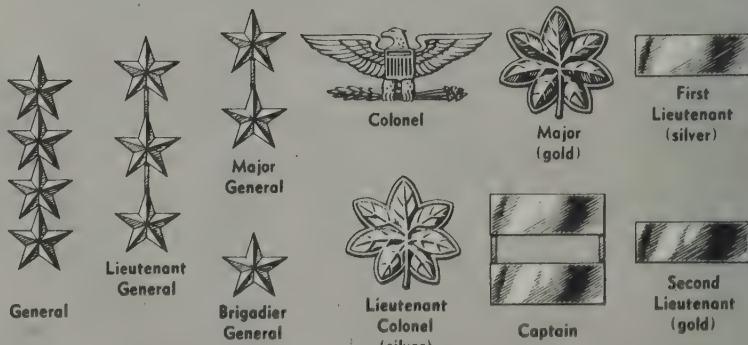
Navy.—Officers' rank is indicated by gold stripes around the lower sleeve of blue uniforms and by shoulder board devices on other uniforms. Line and engineering officers wear a gold circle of wheat above sleeve stripes; officers of other corps wear, between stripes, cloth backing in corps color.

Admiral of the Fleet, Admiral, Vice Admiral, and Rear Admiral: Four (three, two, one) medium above one broad stripe. On gold shoulder board, below sun on blue disk and crossed anchors, four (three, two, one) silver stars.
Commodore: One broad stripe. On gold shoulder board, silver sun and crossed anchors only.
Captain and Commander: Four (three) medium stripes. On shoulder board with two wide gold stripes, silver sun above single silver anchor above three (two) silver stars.
Lieutenant Commander: One narrow above two medium stripes. One silver star.
Lieutenant: Two medium stripes. On shoulder board with three narrow gold stripes, silver sun on blue disk above three silver stars.

INSIGNIA OF RANK

UNITED STATES ARMY
Officers' insigniaUNITED STATES NAVY
Officers' insigniaUNITED STATES
AIR FORCE
Officers' insignia

With the exception of this insignia, insignia of Air Force officers are as for the army.

UNITED STATES MARINE CORPS
Officers' insignia

UNITED STATES ARMY Enlisted personnel insignia



Sergeant Major First Sergeant Master Sergeant



Sergeant, 1st class



Staff Sergeant



Specialist Nine



Sergeant



Corporal



Private, 1st class

UNITED STATES NAVY Enlisted personnel insignia



Master Chief Petty Officer



Senior Chief Petty Officer



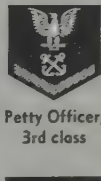
Chief Petty Officer



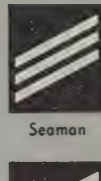
Petty Officer, 1st class



Petty Officer, 2nd class



Petty Officer, 3rd class



Seaman



Seaman Recruit



Seaman Apprentice

UNITED STATES AIR FORCE Enlisted personnel insignia



Chief Master Sergeant



Senior Master Sergeant



Master Sergeant



Technical Sergeant



Staff Sergeant



Airman, 1st class



Airman, 2nd class



Airman, 3rd class



This diamond, worn above the chevrons of any noncommissioned officer, indicates first sergeant of a unit.

UNITED STATES MARINE CORPS Enlisted personnel insignia



Sergeant Major Master Gunnery Sergeant



First Sergeant Master Sergeant



Gunnery Sergeant



Staff Sergeant



Sergeant



Corporal



Lance Corporal



Private, 1st class

Lieutenant (junior grade): One narrow above one medium stripe. Two silver stars.

Sublieutenant: One medium stripe. One star.

Air Force.—Officers' rank is indicated by gold bars below a gold eagle on lower sleeve. Rated officers wear a winged three-bladed propeller on each side of collar; nonrated officers wear a winged two-bladed propeller and wheel.

General, Lieutenant General, and Major General:

Three (two, one) narrow above two wide bars.

Colonel, Lieutenant Colonel, and Major: Three

(two, one) narrow bars above one wide bar.

Captain, First Lieutenant, and Second Lieutenant: Three (two, one) narrow bars.

DENMARK

Army.—Officers wear gold stars on light gray shoulder boards or on shoulder straps (battle dress). Other ranks wear insignia on upper sleeve. Cap device: royal coat of arms on silver-edged red oval surmounted by gold crown and encircled by gold oak leaves.

General, Lieutenant General, and Major General:

Three (two, one) large stars.

Colonel and Lieutenant Colonel: Three (two) medium stars.

Major: Three small 5-pointed stars.

Captain: One small 3-pointed star between two small 5-pointed stars.

First Lieutenant and Lieutenant: Two (one) small 5-pointed stars.

Staff Sergeant, Sergeant, and Corporal: Four (three, two) light gray chevrons, points up.

Navy.—Admirals wear gold stripes around lower sleeve or silver stars (3, 2, 1) on gold mesh on shoulder boards. Other officers wear gold stripes on both. Upper stripes are looped. Warrant officers wear insignia on lower sleeve; petty officers on upper. Cap device: gold anchor on silver-edged red oval surmounted by gold crown and encircled by gold oak leaves.

Admiral, Vice Admiral, and Rear Admiral: Three (two, one) medium above one broad stripe.

Commodore: Four medium stripes.

Captain: One medium above one narrow and two medium stripes.

Commander: Three medium stripes.

Lieutenant Commander: One narrow between two medium stripes.

Lieutenant and Sublieutenant: Two (one) medium stripes.

Chief Warrant Officer: One medium horizontal gold bar above one narrow gold bar.

Warrant Officer: One medium horizontal gold bar.

Petty Officer, 1st, 2d, and 3d class: Four (three, two) gold chevrons, points up.

Air Force.—Officers wear white-edged blue stripes around lower sleeve or on shoulder boards. Cap device: wings on silver-edged red oval surmounted by gold crown and encircled by gold oak leaves.

General, Lieutenant General, and Major General: Three (two, one) medium above one broad stripe.

Colonel: Four medium stripes.

Lieutenant Colonel: One medium above one narrow and two medium stripes.

Major: Three medium stripes.

Captain: One narrow between two medium stripes.

First Lieutenant and Second Lieutenant: Two (one) medium stripes.

FRANCE

Army.—Rank insignia of officers and warrant officers is worn on shoulder straps and on service and field caps; insignia of enlisted personnel is worn on the upper sleeve and on service and field caps. Regimental and corps insignia are colored tabs, worn by officers on coat lapels and on upper shirt sleeves, and by other ranks in the angle below chevrons. Regimental numbers are worn in the center of the tab.

Marshal of France: Seven silver stars. Around service cap, three rows of gold oak leaves.

General, Lieutenant General, and Major General:

Five (four, three) silver stars. Around service cap, two rows of gold oak leaves.

Brigadier General: Two silver stars. Around service cap, one row of gold oak leaves.

Colonel: Five gold (in some branches, silver) stripes, with space between upper two and lower three.

Lieutenant Colonel: Three gold alternating with two silver stripes (reversed in some branches).

Major: Four gold stripes, spaced one and three.

Captain, Lieutenant, and Sublieutenant: Three (two, one) gold stripes.

Warrant Officer, 1st and 2d class: On a gold (silver) stripe, a thin longitudinal red stripe.

Sergeant Major: Four gold chevrons, point up, with space between upper one and lower three.

Sergeant, 1st class: Three gold chevrons.

Sergeant: One red above one gold chevron.

Corporal, 1st class: One gold above two red chevrons.

Corporal and Private, 1st class: Two (one) red chevrons.

Navy.—Rank of officers and warrant officers is indicated by gold stripes around the lower sleeve of blue uniforms and on shoulder straps of other uniforms; petty officers and seamen wear insignia on the lower sleeve. Officers wear on the service coat shoulder a gold strap parallel to the sleeve seam, with width and amount of embroidery indicating grade. Officers wear around the cap band the same pattern of stripes worn on the sleeve. The cap device for all ranks is an anchor within a wreath, in gold.

Admiral: Five silver stars.

Vice Admiral Commanding Afloat: Four stars.

Vice Admiral and Rear Admiral: Three (two) stars.

Captain: Five gold stripes, with space between upper two and lower three.

Commander: Three gold alternating with two silver stripes, spaced as above.

Lieutenant Commander: Four gold stripes, spaced one above three.

Lieutenant, Lieutenant (junior grade), and Ensign: Three (two, one) gold stripes.

Warrant Officer, 1st and 2d class: Below one broad gold stripe, two (one) narrow stripes.

Chief Petty Officer; Petty Officer, 1st and 2d class: Three (two, one) diagonal gold stripes.

Leading Seaman, 1st class; Leading Seaman; and

Able Seaman: Three (two, one) diagonal red stripes.

Air Force.—Titles and rank insignia of officers and warrant officers are the same as for the army. On the blue service coat, officers wear the gold shoulder strap worn by the navy. On service and field caps all ranks wear a device of gold wings, above which general officers wear a pattern of five gold stars. Wings denoting flying rating are worn on the right breast pocket. Rank insignia for enlisted personnel, worn on shoulder straps, are as follows:

Master Sergeant: Three gold chevrons, point up, above one horizontal gold stripe.

Sergeant, 1st class; Sergeant (Professional); and Sergeant: Three (two, one) gold chevrons. *Corporal, 1st class*: One gold above two red chevrons.

Corporal and Private, 1st class: Two (one) red chevrons.

FEDERAL REPUBLIC OF GERMANY (WEST GERMANY)

Army.—Rank insignia of officers and sergeants major is worn on shoulder straps of all uniforms; other enlisted personnel wear chevrons on the upper sleeve. General officers wear gold edging on shoulder straps and on the coat collar above the lapel notch; other officers wear silver edging; sergeants major wear old-gold edging on collar only. General officers wear red lapel tabs with a gold laurel design. All ranks wear as an upper cap device the national yellow, red, and black rosette. The lower cap device consists of crossed sabers on a wreath of oak leaves, in gold for general officers, silver for other officers, and light bronze for enlisted personnel. General officers wear oak leaves on the cap visor. On the field cap the crossed sabers are worn without the wreath. All ranks wear branch insignia on the upper lapels of the service coat.

Lieutenant General, Major General, and Brigadier General: A semicircular wreath of four oak leaves below three (two, one) gold four-pointed stars.

Colonel, Lieutenant Colonel, and Major: Silver wreath below three (two, one) silver stars.

Captain, First Lieutenant, and Lieutenant: Three (two, one) silver stars.

Senior Staff Sergeant Major, Staff Sergeant Major, Senior Sergeant Major, and Sergeant Major: In old-gold metal, four (three, two, one) chevrons, point up, in pairs and singles. *Staff Sergeant and Sergeant*: Two (one) gold cloth chevrons, point up.

Senior Corporal, Corporal, and Private, 1st class: Three (two, one) diagonal gold stripes.

Navy.—Officers' rank is indicated by gold stripes around the lower sleeve of the blue service uniform and on shoulder boards of other uniforms; officers of the line wear a gold star above the sleeve stripes, but not on shoulder boards. Flag officers wear the same stripes on shoulder boards as on sleeves. Boatswains wear insignia on the lower sleeve, other enlisted ranks on the upper sleeve, in gold on blue uniforms and blue on white uniforms. The cap device is an anchor in a wreath of oak leaves, in gold, worn below the yellow, red, and black rosette. Flag officers wear oak leaves on the cap visor.

Officers' rank insignia of rank is the same as for the United States Navy, except *Commodore*, which is one narrow above one broad stripe. Rank insignia for enlisted personnel is as follows:

Senior Staff Boatswain, Staff Boatswain, Senior Boatswain, and Boatswain: Four (three, two, one) chevrons, point up, in pairs and singles. *Senior Petty Officers and Petty Officers*: Two (one) chevrons on upper sleeve. *Seaman, 1st, 2d, and 3d class*: Three (two, one) diagonal stripes on upper sleeve.

Air Force.—Titles and rank insignia of all personnel are the same as for the army, and the uniform is basically the same. All ranks wear around lower sleeves of service and field coats a blue band edged in silver on which is centered a pair of silver wings. The cap device, worn below the national rosette, is a pair of wings, in gold for general officers, silver for other officers, and light bronze for enlisted personnel, on a wreath of the same color on the service cap and without wreath on the field cap.

ITALY

Army.—Officers and warrant officers wear rank insignia on shoulder straps of all uniforms, and on tabs of shoulder-strap design on field caps. Noncommissioned officers wear insignia on the upper sleeve. All ranks wear on lapel tabs the national star, gold for general officers and silver for all others. Branch is indicated by color and shape of lapel tabs. The cap device for general officers is a spread eagle in a wreath; other personnel wear regimental or corps devices. The color and design of officers' chin straps indicates grade.

Lieutenant General, Major General, and Brigadier General: On blue-and-silver shoulder strap, three (two, one) gold stars edged in red.

Colonel, Lieutenant Colonel, and Major: On shoulder strap edged in gold braid, three (two, one) gold stars.

Captain, First Lieutenant, and Second Lieutenant: Three (two, one) gold stars.

Aiutante di Battaglia: On a red tab, three lines of gold braid radiating from button.

Warrant Officer, 1st, 2d, and 3d class: Three (two, one) lines of gold braid extending fanwise from shoulder strap button.

First Sergeant and Sergeant: Two (one) narrow below one broad gold chevron, point down.

First Corporal and Corporal: Same, in black.

Navy.—Officers' rank is indicated by gold stripes about $2\frac{1}{2}$ inches long on lower sleeve of blue uniforms and on shoulder boards of other uniforms, upper stripe forming a loop. Warrant officers wear insignia across the shoulder seam, petty officers on the upper sleeve. Officers, warrant officers, and chief petty officers wear on lapels the national star in silver and, as a cap device, an anchor within oak leaves surmounted by a three-turreted tower, in gold. Design of officers' chin straps indicates grade.

Vice Admiral of the Fleet, Vice Admiral, and Rear Admiral: Above a frieze design, three (two, one) medium stripes. On gold shoulder board, three (two, one) gold stars. *Captain, Commander, and Lieutenant Commander*:

Three (two, one) medium above one broad stripe.

Lieutenant, Lieutenant (junior grade), and Ensign: Three (two, one) medium stripes.

Warrant Officer, 1st, 2d, and 3d class: Three (two, one) gold bars interwoven with blue.

Chief Petty Officer, 1st and 2d class: Two (one) narrow below one broad gold chevron, point down.

Petty Officer: One broad above two narrow red chevrons.

Seaman, 1st class: One narrow red chevron.

Air Force.—Officers' rank insignia is identical with that of the navy except that the upper stripe forms a lozenge. Officers wear on the shoulders of the service coat a transverse strap with gold wings within a gold border. Insignia of warrant and noncommissioned officers is worn on shoulder straps. All ranks wear the national star in silver on upper lapels. The cap device is an eagle in a wreath surmounted by a three-turreted tower, in gold. Officers' gold chin straps vary in design indicating grade.

Officers' titles are as for the army, and rank insignia as for corresponding navy grades. Rank insignia of other personnel is as follows:

Aiutante di Battaglia: A silver star centered on three vertical gold bars, blue interwoven.

Warrant Officer, 1st, 2d, and 3d class: Three (two, one) vertical gold bars, blue interwoven.

First Sergeant and Sergeant: One broad above two (one) narrow gold chevrons, point down.

First Corporal and Corporal: One broad above two (one) narrow red chevrons.

REPUBLIC OF KOREA

Army.—Officers and warrant officers wear rank insignia on shoulder straps of all uniforms and on collar of shirt when worn as an outer garment. Enlisted rank insignia, undergoing change, was not yet standardized in 1956.

General, Lieutenant General, Major General, and Brigadier General: Four (three, two, one) silver stars.

Colonel, Lieutenant Colonel, and Major: Three (two, one) silver nine-petaled bamboo blossoms.

Captain, First Lieutenant, and Second Lieutenant: Three (two, one) silver diamonds.

Warrant Officer: One gold diamond.

Navy.—Rank of officers is indicated by gold stripes around the lower sleeve of blue uniforms and on shoulder boards. Number of stripes is the same as for the United States Navy, but without the gold star. On shirt collars and field uniforms, officers and warrant officers wear metal insignia as for the army. Rank insignia for enlisted personnel, worn on the upper sleeve, is as follows:

Chief Petty Officer: Three chevrons, point down, below one narrow arc.

Petty Officer, 1st, 2d, and 3d class: Three (two, one) chevrons.

Seaman, 1st and 2d class, and Apprentice Seaman: Three (two, one) horizontal bars.

Air Force.—Titles and rank insignia of officers and warrant officers are the same as for the army. Enlisted insignia is undergoing change.

NETHERLANDS

Army.—Rank insignia of officers and warrant officers is worn on lapel tabs of service and battle dress, that of other ranks on the upper left sleeve. Officers wear branch insignia on shoulder straps; other ranks, on cap and beret. A gold national emblem is the officers' cap device and is also worn by all ranks as a flash on the upper left sleeve.

General: On gold-edged red lapel tab, crossed gold batons above four silver stars in square.

Lieutenant General: Four silver stars in square.

Major General: Two silver above two gold stars.

Colonel, Lieutenant Colonel, and Major: On red tab, below horizontal gold stripe, three (two, one) silver stars.

Captain, First Lieutenant, and Second Lieutenant: Three (two, one) silver stars.

Warrant Officer: One round silver button.

Sergeant Major: Two gold-bullion chevrons, point up.

Sergeant, 1st class: One gold-bullion chevron below one half-width chevron.

Sergeant: One gold-bullion chevron.

Corporal, 1st class, and Corporal: Two (one) chevrons of gold cloth.

Private, 1st class: One red chevron.

Navy.—Officers' rank is indicated by gold stripes around the lower sleeve of blue uniforms and on shoulder boards of other uniforms, the upper stripe forming a loop. Petty officers and seamen wear insignia on the upper sleeve. Officers wear on upper lapels an anchor below a crown, in gold. Officers' cap device is an anchor within oak leaves below a crown, in gold; for petty officers, the same without oak leaves. Flag officers wear two rows of gold braid on cap visors, senior officers one row.

Lieutenant Admiral, Vice Admiral, and Rear Admiral: One medium above one broad stripe, surmounted by four (three, two) silver stars.

Commodore: One broad stripe.

Captain and Commander: Four (three) medium stripes.

Lieutenant Commander: One narrow between two medium stripes.

Lieutenant: Two medium stripes.

Lieutenant (junior grade): One medium above one narrow stripe.

Ensign: One medium stripe.

Chief Petty Officer: Four gold chevrons, point down.

Petty Officer, 1st and 2d class: Three gold chevrons (same for both classes).

Petty Officer, 3d class: Two gold chevrons.

Seaman, 1st and 2d class: Two (one) red chevrons.

Air Force.—Titles and rank insignia of all personnel are the same as for the army. The cap device is a soaring eagle in an oak-leaf wreath below a crown, in gold. General officers and colonels wear gold laurel leaves on cap visor; other field officers wear a gold stripe along visor edge. Gold rating badges are worn over the left breast pocket. Chevrons of sergeants are silver-gray; of corporals, white.

NORWAY

Army.—Officers' rank insignia is worn on lapel tabs of service uniforms and on shoulder

straps of battle dress; insignia of other ranks is worn on the upper sleeve. Cap device for all ranks is a red, white, and blue rosette above the royal emblem in gold on a red disk for officers and on a brown disk for other ranks; these devices are connected by strips of different pattern, indicating grade. Device for battle-dress beret is the royal monogram below a crown, encircled by an oak-leaf wreath, in silver. Branch is indicated by rectangular colored flashes high on upper sleeves.

General, Lieutenant General, and Major General:

On lapel tab or shoulder strap of gold oak-leaf design, three (two, one) silver stars.

Colonel, Lieutenant Colonel, and Major: On tab or strap edged with a silver stripe, three (two, one) silver stars.

Captain, Lieutenant, and Sublieutenant: Three (two, one) silver stars, plain tab or strap.

Master Sergeant: Three chevrons, point up, above a crown.

Sergeant, Corporal, and Private, 1st class: Three (two, one) chevrons.

Navy.—Officers' rank is indicated by gold stripes around lower sleeve or on shoulder boards, upper stripe forming a loop. Chief petty officers wear insignia on lower sleeve, petty officers on extreme upper sleeve. Cap device for officers is an anchor within oak leaves below a crown, in gold; for petty officers, same without oak leaves.

Admiral, Vice Admiral, and Rear Admiral: A broad stripe with one medium stripe below and three (two, one) medium stripes above.

Commodore: Three medium above one broad stripe.

Captain and Commander: Four (three) medium stripes.

Lieutenant Commander: One narrow between two medium stripes.

Lieutenant and Lieutenant (junior grade): Two (one) medium stripes.

Chief Petty Officer, 1st and 2d class: Two (one) gold chevrons, point up.

Petty Officer, 1st, 2d, and 3d class: Below a red anchor and crown device, three (two, one) diagonal red stripes.

Seaman, 1st class: On lower sleeve, a red crown.

Air Force.—Titles and rank insignia for all personnel are the same as for the army. Officers' cap device is a red, white, and blue rosette within oak leaves, surmounted by spread wings below a crown, in silver; cap devices for other ranks are as for the army. Rating badges in silver are worn over right breast pocket.

PORTUGAL

Army.—Officers' rank insignia is worn on the lower sleeve of service dress and on the shoulder straps of battle dress; insignia of other ranks is worn on upper sleeve and shoulder straps. Branch is indicated by cap devices for all ranks and by colored collar tabs for officers.

Lieutenant General, Major General, and Brigadier: Four (three, two) silver stars.

Colonel, Lieutenant Colonel, and Major: Three (two, one) narrow gold stripes, $2\frac{1}{2}$ inches long, above one broad stripe.

Captain, Lieutenant, and Sublieutenant: Three

(two, one) narrow gold stripes.

Warrant Officer: Coat of arms in gold wreath.

First Sergeant and Sergeant: Four (three) gold chevrons, point up.

First Corporal: Three gold chevrons, point down.

Corporal and Private, 1st class: Two (one) black chevrons edged in white, point up.

Navy.—Officers' rank is indicated by gold stripes around lower sleeve and on shoulder boards, upper stripe forming a loop. Warrant officers wear insignia on lower sleeve, other ranks on upper sleeve. Cap device for officers and petty officers is a silver anchor within gold oak leaves below gold coat of arms.

Admiral and Vice Admiral: Above one broad stripe, two (one) medium stripes.

Rear Admiral: One broad stripe.

Captain and Commander: Four (three) medium stripes.

Lieutenant Commander: One narrow between two medium stripes.

Lieutenant and Sublieutenant: Two (one) medium stripes.

Warrant Officer: Coat of arms in gold wreath.

Chief Petty Officer and Petty Officer, 1st class: Four (three) gold chevrons, point up.

Petty Officer, 2d class: Three gold chevrons, point down.

Petty Officer, 3d class, and Seaman, 1st class: Two (one) red chevrons, point up.

Air Force.—Titles and rank insignia of all ranks are the same as for the army. Cap device is the coat of arms within gold oak leaves. Gold rating badges are worn above left pocket.

SWITZERLAND

Army.—Officers' rank insignia is worn on shoulder straps of service and field uniforms, on field-cap tabs, and around service cap. Insignia of other ranks is worn on upper sleeve. Branch is indicated by color and design of lapel tabs; unit numbers are worn on shoulder straps of branch color. Enlisted specialist ratings are worn above chevrons. Gold rating badges, including flying ratings (the air force is part of the army), are worn above left pocket.

General: On gold-edged black background, four silver stars on row of gold leaves. Around service cap, on black background, broad band of gold leaves above a medium band and below a narrow band.

Colonel Commanding Corps: On same background, three stars. Around service cap, one broad between two narrow bands of gold leaves.

Colonel Commanding Division: Same background with two stars. Around service cap, one broad below one narrow band of gold leaves.

Colonel Brigadier: Same background with one star. Around service cap, one broad band of leaves. Colonel brigadiers not in command wear the same without black background.

Colonel, Lieutenant Colonel, and Major: Three (two, one) broad gold stripes.

Captain, First Lieutenant, and Lieutenant: Three (two, one) narrow gold stripes.

Warrant Officer: One gold chevron (point up) above and two chevrons below a gold cross within gold wreath.

Sergeant Major: Two chevrons below same device.

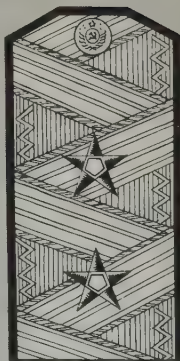
UNION OF SOVIET SOCIALIST REPUBLICS



Marshal of the
Soviet Union, Army



Admiral of the Fleet,
Navy (sleeve)



Major General,
Air Force

FRANCE



Marshal of France,
Army



Admiral, Navy
(sleeve)



General officers' cap badge,
Air Force

BRAZIL



General of Army

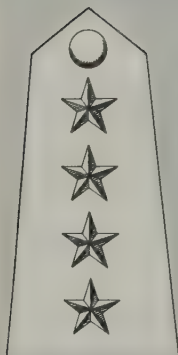


Admiral, Navy



Officers' cap badge,
Air Force

REPUBLIC OF KOREA



General, Army



Admiral, Navy
(sleeve)

BELGIUM

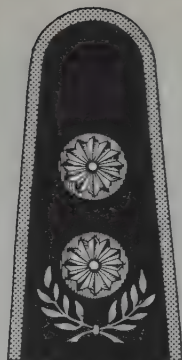


Lieutenant General,
Army (lapel tab)



Commodore, Navy
(sleeve)

ARGENTINA



General of Division,
Army



Admiral, Navy

FEDERAL REPUBLIC OF GERMANY



Lieutenant General,
Army and Air Force



Vice Admiral,
Navy (sleeve)

UNITED KINGDOM



Field Marshal,
Army



Colonel, Royal Marines

CANADA



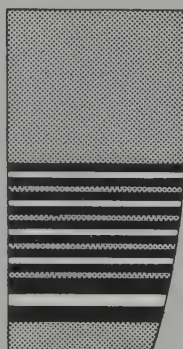
General,
Army



Captain,
Army



Admiral of the Fleet,
Navy



Marshal of the
Royal Air Force
(sleeve)



Rear Admiral,
Navy



Lieutenant,
Navy



Qualified pilots' wings,
Royal Air Force



Qualified pilots' wings,
Royal Canadian Air Force

Quartermaster Sergeant: One chevron above and one below same device.

Sergeant: One chevron below same device.

Corporal: One chevron.

Lance Corporal: One horizontal gold stripe.

TURKEY

Army.—Officers wear rank insignia on shoulder straps, other personnel on the upper sleeve. Officers' cap device is a crescent, points up, with star between points, within oak-leaf wreath, in gold. General officers wear two rows of gold braid on cap visor; senior officers wear one row. Branch is indicated by colored lapel tabs and by enlisted men's cap devices.

Field Marshal: On gold tab on red shoulder strap, crescent and star on crossed batons.

General: On gold-edged shoulder strap, the same.

Lieutenant General, Major General, and Brigadier General: On plain shoulder strap, the same device below three (two, one) gold stars.

Colonel, Lieutenant Colonel, and Major: Crescent and star below three (two, one) stars.

Captain, First Lieutenant, and Second Lieutenant: Three (two, one) gold stars.

Master Sergeant: Four gold chevrons, point down, with gold crescent and star in angle above.

First Sergeant, Staff Sergeant, Sergeant, and Corporal: Four (three, two, one) chevrons.

Navy.—Officers' rank is indicated by gold stripes around lower sleeve and on shoulder boards, upper stripe forming a loop; insignia of other ranks is worn on upper sleeve. Cap device for officers is an anchor on blue oval in wreath below crescent and star, in gold; for petty officers, anchor on oval below gold knot, surmounted by gold crescent and star. Flag officers wear two rows of gold braid on cap visor; senior officers, one row.

Admiral of the Fleet: Four medium stripes above one broad stripe.

Admiral: From the top: one medium, one narrow, two medium, and one broad stripe.

Vice Admiral, Rear Admiral, and Commodore: Three (two, one) medium above a broad stripe.

Captain: Four medium stripes.

Commander: One narrow below one medium and above two medium stripes.

Lieutenant Commander and Commander Lieutenant: Three (two) medium stripes.

Lieutenant: One medium above one narrow stripe.

Lieutenant (junior grade): One medium stripe.

Ensign: One narrow stripe.

Chief Petty Officer: Four gold chevrons, point down, below gold crescent and star in angle.

Petty Officer, 1st and 2d class; Leading Seaman; and Seaman, 1st class: Four (three, two, one) gold chevrons.

Seaman, 2d class: Plain upright gold anchor.

Air Force.—Titles and rank insignia are as for the army. Cap device is also the same, but with a soaring eagle superimposed on crescent.

Silver rating wings with crescent and star in center are worn over left breast pocket.

UNION OF SOVIET SOCIALIST REPUBLICS

Army.—Officers' rank insignia is worn on

shoulder boards, collar patches, and coat cuffs. Other ranks wear insignia on shoulder boards and collar patches. On the cap, general officers wear a large red star on gold disk; all other ranks wear a red star only. Gold collar-patch ornamentation consists of oak leaves for marshals, laurel leaves for generals, two horizontal bars with zigzag lines for field officers, one such bar for company officers, and one plain bar for non-commissioned officers. Gold cuff ornamentation for marshals and generals is a band of oak and laurel leaves respectively; field officers, two vertical pillars; company officers, one pillar. Branch is indicated by color of shoulder boards and collar patches, and by metal shoulder board devices. Personnel of technical branches wear silver ornamentation.

General officers wear gold or silver shoulder boards for service and olive drab for field, edged in red (magenta for service branches). Field officers wear gold or silver service shoulder boards, edged and with two longitudinal stripes in branch color; field shoulder boards are olive drab edged in branch color with two stripes in claret (brown for service branches). Company officers' shoulder boards are the same with one central stripe only. Other ranks wear service shoulder boards in branch color, field shoulder boards of olive drab; metal branch insignia is worn on service shoulder boards only. Enlisted ranks are indicated by transverse gold or silver stripes on service shoulder boards and claret stripes on field shoulder boards.

Marshal of the Soviet Union: A very large silver star below the national coat of arms.

Chief Marshal: Large silver star within silver oak-leaf wreath, below branch insignia.

Marshal: Large silver star below branch insignia.

General, Lieutenant General, Major General, and Brigadier General: Four (three, two, one) small silver stars.

Colonel, Lieutenant Colonel, and Major: On two-stripe shoulder boards, three (two, one) silver stars, below branch insignia.

Captain, Senior First Lieutenant, First Lieutenant, and Second Lieutenant: On one-stripe shoulder boards, four (three, two, one) silver stars, below branch insignia.

Master Sergeant: One broad stripe intersected by a narrow longitudinal stripe.

Sergeant 1st Class: One broad stripe.

Sergeant, Corporal, and Private, 1st class: Three (two, one) narrow stripes.

Navy.—All personnel wear rank insignia on shoulder boards of all uniforms. Line officers also wear gold stripes around lower sleeve of blue uniforms, with gold star above stripes (flag officers, large gold star surmounting hammer and sickle). Various corps are indicated by shoulder board colors and metal insignia.

Line officers' sleeve stripes are the same as for the United States Navy, except lieutenant commander (one narrow above two medium stripes). Shoulder board insignia is as follows:

Admiral of the Fleet: On gold shoulder board, a large silver star with anchor in red center.

Admiral, Vice Admiral, and Rear Admiral: Same, with three (two, one) small silver stars.

Commodore, Captain, and Commander: On gold shoulder board with two longitudinal stripes in corps color, three (two, one) silver stars.

Lieutenant Commander, Lieutenant, Lieutenant (junior grade), and Ensign: On same with one stripe, four (three, two, one) silver stars.

Warrant Officer: On shoulder board in corps color, a broad gold transverse stripe intersected by a narrow longitudinal stripe.

Chief Petty Officer: One broad gold stripe.

Petty Officer, 1st and 2d class, and Seaman, 1st class: Three (two, one) narrow gold stripes.

Air Force.—Titles and rank insignia are as for the army, with sky-blue as branch color. As officers wear a roll-collar coat, the metallic device of a vertical propeller centered on horizontal wings is worn on lapel tabs.

UNITED KINGDOM

Army.—Rank insignia is worn by officers on shoulder straps, by warrant officers on lower sleeve, and by other ranks on upper sleeve. General officers wear red lapel tabs with vertical gold laurel stripe, brigadiers and colonels with black braid stripe. Other officers wear regimental or corps devices on lapels. Colonels and above wear a red band around the cap. Cap device for field marshals is crossed red batons on gold laurel wreath, surmounted by lion atop crown; general officers, same with crossed baton and sword; brigadiers and colonels, crown surmounted by lion. Other officers wear regimental or corps devices.

Field Marshal: Crossed red batons on gold laurel wreath surmounted by gold crown.

General: Crossed gold sword and baton below a four-pointed gold star below a gold crown.

Lieutenant General and Major General: Crossed sword and baton below gold crown (gold star).

Brigadier, Colonel, and Lieutenant Colonel: Below a gold crown, three (two, one) gold stars.

Major: A gold crown.

Captain, Lieutenant, and Second Lieutenant: Three (two, one) gold stars.

Warrant Officer, class I: Gold coat of arms.

Warrant Officer, class II: Gold crown in wreath.

Staff Sergeant: Three chevrons, point down, with gold crown in the upper angle.

Sergeant, Corporal, and Lance Corporal: Three (two, one) chevrons.

Navy.—Officers' rank is indicated by gold stripes around lower sleeve of blue uniforms, the upper stripe forming a loop, and on shoulder boards of other uniforms. Non-line officers wear colored backing in corps color between stripes. Chief petty officers wear insignia on lower sleeve, petty officers and seamen on upper left sleeve only. Flag officers wear two rows of gold leaves on cap visor; captains and commanders, one row. Officers' cap device is a silver anchor within gold wreath below a red-backed gold crown; chief petty officers, a silver anchor within gold ring within gold wreath below a red-backed gold crown; petty officers, the same without wreath.

Admiral of the Fleet: Four medium stripes above a broad stripe. On gold shoulder board, crossed batons on laurel wreath below royal monogram, in silver, surmounted by gold crown.

Admiral, Vice Admiral, and Rear Admiral: Three (two, one) medium stripes above a broad stripe. On gold shoulder board, three small (two small, one large) silver stars below crossed sword and baton surmounted by gold crown.

Commodore: One broad stripe.

Captain and Commander: Four (three) medium stripes.

Lieutenant Commander: One narrow between two medium stripes.

Lieutenant and Sublieutenant: Two (one) medium stripes.

Warrant Officer: One narrow stripe.

Chief Petty Officer: Three gold buttons.

Petty Officer: Crossed red anchors below crown.

Leading Seaman: Upright red anchor.

Titles and rank insignia for the Royal Marines are as for the army. The letters "RM" in gold are worn on outer edge of shoulder straps. Cap device is a silver hemisphere within gold wreath, on red background, surmounted by lion atop crown in gold.

Air Force.—Officers' rank is indicated by blue stripes, edged in black, around lower sleeve of service coat and on shoulder straps of other uniforms. Warrant officers wear insignia on lower sleeve, other ranks on upper sleeve. Cap device for grades of air marshal is a soaring eagle within wreath surmounted by lion atop crown, in gold; for other officers, soaring eagle above laurel spray and below crown, in gold; for other ranks, the letters "RAF" within wreath below crown, in gold. Flying rating badges are worn above left breast pocket.

Marshal of the Royal Air Force, Air Chief Marshal, Air Marshal, and Air Vice Marshal: Four (three, two, one) medium stripes above one broad stripe.

Air Commodore: One broad stripe.

Group Captain and Wing Commander: Four (three) medium stripes.

Squadron Leader: One narrow between two medium stripes.

Flight Lieutenant and Flying Officer: Two (one) medium stripes.

Pilot Officer: One narrow stripe.

Warrant Officer, class I: Coat of arms.

Warrant Officer, class II: Crown within wreath.

Flight Sergeant: Three blue chevrons, point down, below gold crown.

Sergeant and Corporal: Three (two) chevrons.

Senior Aircraftman: Three-bladed propeller.

Leading Aircraftman: Horizontal two-bladed propeller.

Chief Technician: Three chevrons, point up, below gold crown.

Senior Technician, Corporal Technician, and Junior Technician: Three (two, one) chevrons, point up.

UNITED STATES

Army.—Officers' rank insignia is worn on shoulder straps of service, semidress, and dress uniforms, on lower sleeve of mess and evening dress uniforms, and on collar of shirt when worn as outer garment. The dress-uniform shoulder strap, worn parallel to the sleeve seam, is gold-bordered with backing and trim in branch colors; officers below colonel wear pairs of insignia thereon. General officers of the line wear rank insignia on both sides of shirt collar; other officers wear rank insignia on right and branch insignia on left; warrant officer insignia is worn on left. Officers and warrant officers wear rank insignia on left side of garrison cap. Enlisted personnel wear rank insignia on upper sleeve.

Cap device for officers is the United States coat of arms in gold; for enlisted personnel, a smaller coat of arms on a disk. Warrant officers wear on cap and lapel a wreath superimposed on a spread eagle, in gold.

General of the Army: Five silver stars in a circle below the national coat of arms in gold and colored enamel.

General, Lieutenant General, Major General, and Brigadier General: Four (three, two, one) silver stars.

Colonel: Silver spread eagle.

Lieutenant Colonel: Silver oak leaf.

Major: Gold oak leaf.

Captain: Two silver bars.

First Lieutenant: One silver bar.

Second Lieutenant: One gold bar.

Chief Warrant Officer W-4 and W-3: A brown enamel bar edged in silver with two (one) transverse silver stripes.

Chief Warrant Officer W-2 and Warrant Officer W-1: brown enamel bar edged in gold with two (one) transverse gold stripes.

Sergeant Major, First Sergeant, and Master Sergeant: Three chevrons, point up, above three descending arcs, with centered star (diamond, blank).

Sergeant 1st class and Staff Sergeant: Three chevrons above two (one) arcs.

Sergeant, Corporal, and Private 1st class: Three (two, one) chevrons.

Specialist Nine and Specialist Eight: Three ascending arcs above two (one) chevrons, point down, with centered eagle and shield.

Specialist Seven, Six, Five, and Four: Above the eagle and shield three (two, one, no) arcs.

On blue and white mess uniforms, officers' rank is indicated by the number of rows of an ornamental knot on lower sleeve; general officers wear a band of oak leaves on a velvet stripe below silver stars of grade. On evening dress, metal rank insignia is worn within a single ornamental knot on lower sleeve. On service and dress caps, field and general officers wear gold oak leaves on visor; on blue dress cap, general officers also wear gold oak leaves around cap band.

On upper lapels of service and dress coats officers wear the letters "US" in gold; on lower lapels, branch insignia. Insignia for enlisted personnel is similar, but mounted on gold disks. The various branch insignia, and colors which determine dress-uniform trim and garrison-cap piping (enlisted personnel), are as follows:

Adjutant General's Corps: Red, white, and blue enameled shield; dark blue and scarlet.

Armor: M-26 tank on crossed sabers; yellow.

Artillery: Crossed cannons and missile; scarlet.

Chaplains: Christian, Latin cross; Jewish, Star of David above Mosaic tablets; black.

Chemical Corps: Benzene ring centered on crossed retorts; cobalt blue and golden yellow.

Corps of Engineers: Castle; scarlet and white.

Finance Corps: Diamond; silver gray and golden yellow.

General Staff: United States coat of arms on silver star; gold and black.

Infantry: Crossed muskets; light blue.

Inspector General's Department: Crossed sword and fasces wreathed; dark blue and light blue.

Judge Advocate General's Corps: Crossed sword and pen wreathed; dark blue and white.

Medical Service: Medical Corps has plain caduceus; other corps (such as *Dental, Nurse*), have superimposed letters; maroon and white.

Military Police Corps: Crossed pistols; yellow and green.

National Guard Bureau: Crossed fasces superimposed on eagle; dark blue.

Ordnance Corps: Flaming bomb; crimson and yellow.

Professors, United States Military Academy: On shield, helmet of Pallas on Greek sword, below eagle and scroll; scarlet and silver gray.

Quartermaster Corps: Crossed sword and key on wheel surmounted by an eagle; buff.

Signal Corps: Flaming torch centered on crossed signal flags; orange and white.

Transportation Corps: On ship's wheel, winged wheel on shield; brick red and golden yellow.

Women's Army Corps: Helmeted head of Pallas Athene; old gold and moss green.

Navy.—Rank of officers and warrant officers is indicated by gold stripes around lower sleeve of blue uniforms and on shoulder boards of other uniforms. Line officers wear a gold star above stripes; other officers, gold corps devices; warrant officers, specialist rating devices. Rank insignia and specialist ratings of petty officers and seamen are worn on upper sleeve. With some uniforms, officers wear on shirt collar metal rank insignia identical with that of the army; line officers on both sides of collar, other officers rank insignia on right and corps insignia on left. Warrant officers' metal insignia is the same as for the army, with background in blue instead of brown. Cap device for officers is a silver shield on crossed gold anchors below silver spread eagle; for warrant officers, crossed gold anchors; for chief petty officers, an upright gold anchor with letters "USN" across shank. Flag officers wear two rows of gold oak leaves on cap visor, captains and commanders wear one row.

Fleet Admiral: Four medium stripes above one broad stripe. On gold shoulder board, five silver stars in circle below silver foul anchor.

Admiral, Vice Admiral, and Rear Admiral: Three (two, one) medium stripes above one broad stripe. On gold shoulder board, four (three, two) silver stars below silver foul anchor.

Commodore: One broad stripe. On gold shoulder board, one silver star below silver anchor.

Captain and Commander: Four (three) medium stripes.

Lieutenant Commander: One narrow between two medium stripes.

Lieutenant: Two medium stripes.

Lieutenant (junior grade): One narrow above one medium stripe.

Ensign: One medium stripe.

Chief Warrant Officer W-4, W-3, and W-2: One medium stripe with one (two, three) square blue tabs superimposed thereon.

Warrant Officer W-1: Narrow stripe, three tabs.

Master Chief Petty Officer, Senior Chief Petty Officer, and Chief Petty Officer: Three chevrons, point down, below ascending arc enclosing specialist rating, surmounted by eagle and two (one, no) stars.

Petty Officer, 1st, 2d, and 3d class: Three (two, one) chevrons below rating and eagle.

Seaman, Seaman Apprentice, and Seaman Recruit: Three (two, one) diagonal white (blue) stripes.

Insignia worn above stripes and on collars by officers of the various corps is as follows:

Medical Corps: Silver acorn on gold oak leaf (with variations for other medical services).

Supply Corps: Spray of three gold oak leaves.

Civil Engineer Corps: Four gold oak leaves and two silver acorns, in diamond pattern.

Chaplains: Christian, gold Latin cross; Jewish, gold Star of David above Mosaic tablets.

Marine Corps.—Titles and rank insignia of officers are the same as for the army. The one exception is that there is no General of the Marine Corps. Warrant officers also wear similar insignia, with red instead of brown background. Cap device for all personnel is a half globe portraying the Western Hemisphere, pierced diagonally by a foul anchor, surmounted by a spread eagle; this device is worn in bronze with service uniform, in silver with officers' dress uniform, and in gold with enlisted men's dress uniforms. All personnel wear the same device on garrison cap and on lapels of service and dress coats.

Insignia of rank of enlisted personnel, worn on the upper sleeve is as follows:

Sergeant Major and Master Gunnery Sergeant: Three chevrons, point up, above four descending arcs, with centered star (bursting bomb).

First Sergeant and Master Sergeant: Three chevrons above three arcs, with centered diamond (crossed rifles).

Gunnery Sergeant and Staff Sergeant: Three chevrons above two (one) arcs, with crossed rifles.

Sergeant, Corporal, and Lance Corporal: Three (two, one) chevrons above crossed rifles.

Private 1st class: One chevron.

Air Force.—Titles and rank insignia of officers are as for the army, warrant officers' bars having a light blue background. The one exception is for the General of the Air Force; the national coat of arms is omitted from that insignia. Cap device for both officers and warrant officers is the same as for army officers, but of oxidized silver; for airmen, a smaller device encircled by a ring. General officers wear around capband and on visor a pattern of clouds and lightning bolts in aluminum braid; colonels, on visor only. Officers wear the letters "US" in oxidized silver on upper coat lapels, airmen the same encircled by a ring. On the shirt collar, officers and warrant officers wear rank insignia slightly smaller than on the coat.

Chief Master Sergeant and Senior Master Sergeant: Three chevrons, point down, on which is centered a star on circular background, above three descending arcs, the whole surmounted by two (one) shallow chevrons, point up.

Master Sergeant, Technical Sergeant, and Staff Sergeant: Three chevrons and star above three (two, one) arcs.

Airman, 1st, 2d, and 3d class: Three (two, one) chevrons and star.

Coast Guard.—Titles and insignia of rank of all personnel are the same as those of the navy, the highest commissioned grade being that of admiral. In lieu of the navy gold star, officers wear the silver Coast Guard shield above the upper stripe on blue uniforms and on the shoulder

board of other uniforms; flag officers wear the shield superimposed on the shoulder board foul anchor. Warrant officers wear the shield between sleeve stripe and specialist insignia; petty officers and seamen wear the shield on the lower sleeve. The cap device for officers and chief warrant officers is the silver shield superimposed on a gold spread eagle holding a horizontal silver anchor in its talons; for warrant officers, the silver shield superimposed on crossed gold foul anchors; for chief petty officers, the silver shield superimposed on an upright gold anchor.

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INSOLVENCY, ĭn-sŏl'vĕn-sĭ. In a popular sense the word "insolvency" applies only to persons without property of means sufficient to satisfy their creditors. The legal definition embraces all who are unable to pay their debts at maturity in the ordinary course of business, even though they may possess assets exceeding their liabilities. A failure to meet overdue obligations renders a person liable to proceedings against him in a court of insolvency, in which his assets may be taken into the possession of the officers, marshaled, and distributed to his creditors. Should there be an amount in excess of what is required to pay the creditors and the expenses of administration, the balance so remaining is the property of the debtor. From a very early period in the history of civil government, laws have existed providing for proceedings by creditors against insolvent debtors, by which the debtor's property could be taken from his possession, to be held by another as a trust fund to be applied to the payment of his just debts. In case of an insufficient amount to pay all debts in full, provisions are usually made for a pro rata distribution. These laws have generally provided for classes of preferred debts, payments of which were to be made in full, even though such payments exhausted the entire assets. Preferred claims commonly included all claims of the government or state, and often claims for labor to a limited amount, and claims for the necessities of life. Provisions are usually made for the exemption of certain articles to the use of the debtor, not to be included in the assets. The Constitution of the United States provides that Congress may establish uniform laws on the subject of bankruptcy throughout all the states. A uniform national law upon the subject now exists. See also **BANKRUPTCY LAWS**.

INSOMNIA, ĭn-sŏm'nĭ-ă, a disordered condition of the body characterized by sleeplessness, trouble in going to sleep, or awakening after only a few hours. Many victims of insomnia attribute their sleep problems to such things as noise, light, or an uncomfortable bed. These factors can cause some insomnia, but a person in good physical and mental health is not bothered long by them. Among the more serious causes of sleeplessness are mental or emotional problems which keep the victim under such tension that he is unable to relax. This type of tension often creates real physical disorders which cause discomfort and thus may interfere with sleep. Insomnia then becomes a psychosomatic problem, and some degree of psychotherapeutic treatment is needed in conjunction with the physician's efforts to cure the bodily disorder of the sufferer.

Less severe cases of insomnia usually respond to such treatment as warm baths before retiring, or hot food, or anything which will promote easing of muscular tension. Sedative pills should only be used after a physician has prescribed them; they cannot safely be used for any extended period of time and do not attack the causes of insomnia, although they may succeed in bringing sleep quickly.

INSPECTOR or INSPECTOR GENERAL, in-spēk'tēr, a staff officer in the armed forces of a nation. Inspectors general are usually assigned to higher units, installations, and organizations—those commanded by general officers or their naval or air force counterparts. Usually only the chief inspector general in each service holds general officer or equivalent rank. Inspectors general may be members of an established inspector general's department, or they may be other officers temporarily designated. The duties of inspectors general encompass almost every phase of military affairs. They maintain surveillance over: (1) the overall military efficiency and economy; (2) the discipline, conduct, living conditions, training, and morale of individuals and units; (3) the condition of installations, arms, and equipment; (4) the economical and lawful expenditure of funds; and (5) the proper utilization and care of property. In addition, they investigate complaints concerning individuals and conditions, and they conduct special investigations ordered by their superiors. Inspectors general report their findings to the appropriate headquarters with recommendations for corrective action.

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INSPIRATION, in-spi-rā'shūn, literally "in-breathing," by God or His Spirit, which enabled a person (for example, a prophet) to utter divine truth or predict the future. It is a state which accompanies or precedes, and explains, the imparting of divine revelation. In Genesis 2:7, divine inbreathing was the mode by which life was imparted to the first man, a view which presupposes the physical reality of "spirit" or the "breath of life." The term was especially appropriate to describe the seizure of a prophet (Hebrew *nabi*), who thereupon spoke words not his own but presumably from God or a "spirit." This state was also known in Greek religion and in cults elsewhere in the ancient world. The term "enthusiasm" (*enthousiasmos* or *entheos*) explained it, as in the worship of Dionysus (consult Euripides' *Bacchae*, lines 298 ff.), the oracular responses of the Pythia at Delphi, and Plato's description of poetic inspiration (*Ion*, sects. 533D-534). Virgil's *Aeneid* (Book VI, lines 43-54, 77-80, 98-101) gives a classic description of inspiration according to the usual Hellenistic conception: the sibyl is helpless under the powerful seizure by Apollo (consult also Lucan, Book V, lines 161-197; Ovid's *Fasti*, Book VI, lines 535-540). After the 4th century B.C., this primitive conception was revived and became increasingly popular. The later books of the Bible do not assume this cataleptic type of inspiration, except in Acts 2:1-4, where speaking with "other tongues" is interpreted as foreign languages, and I Corinthians 12-14, where Paul reproves the speaking with tongues (*glossolalia*) as unedifying. Instead, it is assumed that reason and self-control must prevail: "the spirits of prophets are subject to prophets" since "God is

not a God of confusion but of peace" (I Corinthians 14:32-33).¹

If we view the Bible as a whole and also take into account the later development of Christian theology, it is clear that three stages of thought are reflected: the inspiration of (1) men or women; (2) their words; and (3) the written record of their words. The basic, fundamental idea is the inspiration of the living man, especially of the prophet; the concept reflects prophetic experience. The New Testament claims a high level of inspiration for the Old Testament writings (Mark 12:36; Matthew 15:4, 1:22; Acts 1:16). The Old Testament contains the "oracles of God" (Romans 3:2, 9:25; I Peter 1:10-12, 4:11; Hebrews 1:1; II Peter 1:21; II Timothy 3:16-17). Like other apocalyptic works, Revelation makes strong claims for inspiration (see 1:3; 10:7, 11; 22:6-9, 18-19, concerning the message; and 1:10; 4:2; 17:3; 21:10, concerning the seer himself and the method of inspiration). Here the later idea of inspiration as ability to predict the future is the main consideration. Similar ideas of inspiration, but with more emphasis on the discernment of divine truth, are found in Philo of Alexandria; consult *On Preliminary Studies*, chap. 24, -sects. 131-136; *On the Special Laws*, Book IV, chap. 8, -sects. 48-52; and compare Flavius Josephus, *Antiquities of the Jews*, Book IV, chap. 6, par. 5, -sects. 118-125.

The constant use of the Old Testament encouraged both Jews and Christians to view their sacred books as inspired. Toward the end of the 2d century A.D. the self-styled prophet Montanus and his followers in Phrygia revived the primitive notion of direct inspiration and predicted the coming of the New Jerusalem (consult Eusebius of Caesarea, *Historia Ecclesiastica*, Book V, chap. 16). Such so-called prophecy has been found in many later centuries. Against it the church has appealed to the Scriptures as final. The Council of Florence (1431-1445) insisted that both Testaments are inspired by the same Holy Spirit; the Vatican Council (1869-1870) stated that "God is the author of sacred scripture." While recognizing that the Bible contains differences in order in relating events and also different levels of inspiration, Martin Luther held that no soul would be lost or saved either by such difficulties or by their solution (consult his *Exposition* of I John 1-2 and 18 in the Erlangen edition of his works, vol. 46, p. 174, and vol. 50, pp. 308 f.). John Calvin insisted that the Scriptures form a unity, without distinction in meaning between the two Testaments; the revealed truth may be recognized by the inner voice which speaks through the Scriptures and awakens the spirit of man—the *testimonium Sanctus Spiritus internum* or *interior Spiritus Sancti persuasio* (*Institutes of the Christian Religion*, 1536, Book I, chap. 36).

Various theories of inspiration have been held, all the way from divine dictation (Athenagoras, *Apology*, Book IX: "like a flute"; compare Epiphanius, *Heresies*, 48:4, against Montanus; compare Plato, *Timaeus*, 71E f.), including even the punctuation (so the *Formula Consensus Helvetica*, 1675), to modern liberal views which recognize inspiration in all deeply moving or illuminating literature or music. *Plenary* inspiration assumes the inspired utterance to cover every subject, even nonreligious; *literal* or *verbal*, that of every word and letter.

The chief objections that have been raised to

¹ Revised Standard Version.

extreme theories of verbal inspiration include: (1) the existence of "self-contradictions" within the Bible, as in parallel stories of the same events; and (2) the existence of lower levels of religious and ethical teaching, as in I Samuel 15; Psalm 137:8f.; Numbers 15:32-36. These are both features of ancient religious tradition which can be explained only on a historical view of its origin and transmission. Other objections to verbal inspiration theories include: (1) the uncertainty of the original text in some passages, a problem which can scarcely be solved by selecting one manuscript as infallible, since most early manuscripts are incomplete; (2) the diversity in the translations, even the ancient ones, so that the verbal inspiration has evidently failed to carry over to the Scriptures actually used by the church in later centuries; and (3) the uncertainty of the meaning of some words in Hebrew and Greek and the inevitable alterations which have taken place in most of them as languages have grown and changed. Most Christians now probably hold that the Bible is inspired in the sense of *inspiring*; as Samuel Taylor Coleridge believed (*Confessions of an Inquiring Spirit*, 1840, quoting Wisdom 7:27), we recognize as inspired what "finds" us in our inmost hearts.

Bibliography.—Sanday, William, *Inspiration*, 3d ed. (London 1896); Hastings, James, ed., *Encyclopaedia of Religion and Ethics*, vol. 8, pp. 346-357; vol. 10, pp. 122-139. (New York, 1908); Dodd, Charles H., *The Authority of the Bible* (New York 1929); Robinson, H. Wheeler, *Inspiration and Revelation in the Old Testament*, rev. by L. H. Brockington and E. A. Payne (New York 1946); Grant, Frederick C., *Introduction to New Testament Thought*, chap. 5 (New York 1950).

FREDERICK C. GRANT.

INSTALLMENT BUYING AND SELLING, in-stōl'mēnt, a system of trading in which the purchaser makes periodic partial payments over a number of weeks, months, or years. The item purchased is usually a consumer good bought at retail. However, purchases may be made at wholesale, and manufacturers' goods are occasionally included. An installment purchase, therefore, involves the extension of credit to the purchaser. The installment payments include interest and service charges, as well as periodic repayments of principal.

A distinction must first be made between installment loan credit and installment sales credit. An installment loan involves the advance of money by a lender to the purchaser, who in turn pays the seller in full. Some equity payment by the borrower is almost invariably required. The bulk of residential mortgage lending in the United States has been made on an installment, or amortized, basis since 1934. In addition, personal finance companies (also known as small loan companies or consumer finance companies), banks, and credit unions make loans to finance the purchase of consumer durable goods. In these instances, money is advanced to the purchaser-borrower and then repaid in periodic, usually equal installments. The purchaser-borrower has title to the goods. The seller receives his money in full. The lender is a creditor only, although in some states a chattel mortgage may be placed on the goods. If the chattel mortgage is employed, the lender can take action to possess and sell the goods in the event of default.

Installment sales credit, on the other hand, involves the extension of credit from the seller to the purchaser. The goods are advanced to

the purchaser after a fractional payment, called the down payment, is made and an installment sales contract is signed. This contract has three distinctive features: (1) title remains with the seller until full payment is made; (2) possession goes with the purchaser; (3) all payments and the goods revert to the seller in the event of default.

The installment sales contract originated with the idea that the goods in question were leased by the purchaser, with the installment payments treated as "rent" but credited against the purchase price. This made recovery of the goods relatively easy at law in the event of default. The legal fiction of a lease contract is still maintained in most jurisdictions. In Great Britain, in fact, the installment plan is still referred to as the hire-purchase plan.

The dealer or seller under an installment sales agreement must in turn obtain financing for his operations. For this purpose, specialized installment sales finance companies have developed. Their function is to provide funds for the sellers by buying the installment sales paper, or by advancing funds with the contracts as security. Such companies are either independent or subsidiaries of large selling concerns; the latter are strongest in the automobile and home appliance field. The subsidiary companies usually advance funds to dealers under what is known as the recourse plan. The dealer becomes liable to the company if loss is incurred as a result of default by the purchaser. Independent sales finance companies do not employ the recourse method.

Installment sales are best suited to the purchase of durable goods, as the benefits from such goods are derived over a prolonged period of time. As a consequence, their prices are relatively high. The prospective purchaser has the alternative of foregoing the enjoyment of the good while he saves the necessary purchase price out of income, or of borrowing the necessary funds and paying out of present income while he enjoys the good. Installment sales credit enhances the consumer's immediate purchasing power.

The use of installment credit in the United States originated in the furniture industry in the 19th century. The first use of installment credit in the sale of automobiles occurred in 1907. By 1910, automobiles accounted for the largest single segment of installment credit; the proportion has grown steadily since that time. After World War II, the enormous business of providing the funds for installment sales credit for automobiles in the United States was concentrated in three firms. The total outstanding automobile installment debt in mid-1957 was \$15 billion, up from less than \$1 billion in 1945 and \$6 billion in 1950.

The importance of installment sales credit, as opposed to installment loan credit, is indicated by the fact that after World War II over 80 per cent of total automobile installment debt was in the form of installment sales credit. The same was true of all other kinds of consumer goods, such as household appliances and furniture.

Not all installment credit is consumer debt, however. Business installment credit is occasionally advanced on durable goods at the wholesale level; but because the essential long-term aspect of asset enjoyment is missing, this is unusual. Also, railroad rolling stock is often financed on a quasi-lease basis via the equipment trust. Finally, real estate is occasionally financed by means of the land contract, which has all the characteristics of the installment sales contract

enumerated above. The only difference is that title may pass when something less than the full amount of the purchase price has been paid, say 60 to 75 per cent.

Total consumer installment credit outstanding in the United States was \$34.1 billion at the beginning of 1958. Of this total, installment sales credit was \$26.2 billion and installment loan credit was \$7.9 billion. See also BANKS AND FINANCE—21. *Installment Lending Institutions*.

Consult Cox, Reavis, *The Economics of Installment Buying* (New York 1948); Phelps, Clyde W., *Financing the Installment Purchases of the American Family*, Studies in Consumer Credit No. 3 (Baltimore 1955); Federal Reserve System Board of Governors, *Consumer Installment Credit*, 3 parts (Washington 1957).

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INSTINCT, in'stingkt, often defined as a behavior pattern that is automatic, stereotyped, innate, inherited, predictable, and unlearned, as opposed to more modifiable learned behavior. Any absolute or even approximate distinction between the two types is, however, false, insofar as all behavior is at some specific point during individual development acquired as an activity of the organism's developing nervous and other associated systems. It may be instinctive for a man to swing his left arm forward as he takes a step with his right leg. He has, however, attained the capacity to coordinate these activities only after undergoing complicated development of his nervous, skeletal, muscular, and circulatory systems.

A question arises as to whether it might be wise to abandon the term "instinctive" as opposed to "learned" behavior, and rather to contrast *generic* behavior with *individual* behavior. Generic behavior would be that which is strictly and rigidly characteristic of the taxonomic category to which an organism belongs (for instance, the building of a specific type of nest by a swift, a hive by a swarm of bees, or the swinging forward of a man's left arm with his right leg); individual behavior would be that in which an organism can to a great extent improvise within the gamut of inherited behavior patterns (for instance, much apparently arbitrary human behavior). Even such a distinction is, however, sometimes blurred. A man can rotate his torso, turning to one side, in his adult life as a willed and individualized action, because he has heard an alarm, or seen a flower, or simply because he wishes to do so; this seems to be a learned and individualistic and acquired competence. Yet an identical movement is an obligatory part of the earliest observed spontaneous activity of every human fetus at about nine to nine and one-half weeks of age, and at this time it is an unlearned activity dependent on the maturation of specific inherited neural mechanisms.

If differences exist between learned and unlearned behavior, they must rest on differences within the organisms' nervous systems, and their analysis is thus to some degree a biological problem. It is, for instance, a biological fact that in organisms such as birds with highly rigid and ritualized behavior patterns evolved in connection with the practice of flight, behavior is governed by a different part of the forebrain than that which is dominant in regulating the more flexible behavior of mammals. Yet even within the realm of strictly biological analysis it remains difficult to correlate the existence of specific behavior

patterns with the structure of the nervous system alone. Symbolization and communication, once believed solely man's prerogatives and considered to have been evolved as a result of the elaboration of his particular kind of brain, are now accepted as accomplished in an entirely different fashion by bees, whose brains bear not the slightest resemblance to those of men in either number or arrangement of structural elements. See also ANIMAL PSYCHOLOGY.

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THEORIES OF INSTINCT

Instinct has traditionally been conceived as comprising complex patterns of behavior which are unlearned, involuntary directive forces in action, appearing in all members of a given species. Thomas Hobbes, in *Human Nature* (1650), differentiated between unlearned propensities in human behavior and those which an individual acquires as a result of experience. By implication, he taught that original human nature consists of instincts. William Paley, the English theologian, who wrote *Natural Theology* (1802), influenced many generations of university students in America and in England with the definition: "A propensity [later called an instinct] exists prior to experience (in the individual) and independent of instruction." These forces, he taught, have a divine origin and supply purposive direction for human behavior.

Alexander Bain (1818–1903), the Scottish psychologist, made the concept of instinct one of the central topics in his popular textbooks (*The Senses and the Intellect*, 1855; *The Emotions and the Will*, 1859). Impressed by Bain's clarity in dealing with this topic, William James adopted many of these concepts about instincts and their place in human behavior. His definition (*Principles of Psychology*, chap. 24) is familiar to all students of psychology: "Instinct is usually defined as the faculty of acting in such a way as to produce certain ends, without foresight of the ends, and without previous education in the performance."

Unlike Bain, James was greatly impressed by Charles R. Darwin's theory of evolution. An obvious kinship between man and lower animals is to be found in the instincts which they share in common. The higher up in the scale of evolution, the more instincts an animal possesses. Man, at the apex of evolution, has the largest number of all, and the most complex. Among those listed by James are the following: pugnacity, rivalry, fear, and acquisitiveness. The instinct of sociability among human beings has its counterpart in the gregarious behavior of many species of lower animals. Some instincts die out in early life, and others appear during later years of human life. Among human beings, James wrote, the instincts undergo many modifications imposed by the social group.

Sir John Lubbock (1834–1913) reported at length upon the manner in which instincts operate among insects, in his book *Ants, Bees, and Wasps* (1882). He believed that, directed by social instincts, these organisms achieve a remarkable order of community life. Many teachers of biology have believed that instincts among lower animals serve as purposeful guides to adaptive behavior. Thus, animals, which are not endowed with human intelligence, are able to survive individually and to maintain the species. The

anecdotal method, used by George John Romanes (1848-1894), furnished an abundance of illustrations about homing behavior, food hoarding, nest building, and the like. Conwy Lloyd Morgan (1852-1936) tried in vain to encourage his students to look for other explanations before invoking the concept of instincts to account for such activities among lower animals.

In 1919, Knight Dunlap (1875-1949) made an important address to the members of the American Psychological Association in which he vigorously criticized the concept of instincts. Much so-called instinctive behavior, he pointed out, is the result of learning. To be certain, if two small boys fight, one might say that they have an instinct of pugnacity; but, if asked to give evidence for that instinct, the instinctivist would have to say, "See! they fight!" Hence, the reasoning goes in a circle. Luther Lee Bernard (1881-), a sociologist at the University of Minnesota, proceeded to review all the literature dealing with instincts, animal and human, that had grown up since Bain. He reported (1924) that the concept is loosely defined, that no two writers ever agreed upon a list of basic instincts, and that much of the behavior called instinctive is the result of the learning process, not an innate endowment. As for lower organisms, Jacques Loeb (1859-1924) accounted for much of their behavior in terms of biochemical changes induced by stimuli. In America, therefore, it became "old fashioned" to make reference to instincts in animal and human psychology. The famous chapter in Bain's *Principles of Psychology*, if read at all, was regarded as a bit of quaint, though brilliant, metaphysical psychology.

In Europe, however, psychologists were not so ready to give up the concept of instinct. William McDougall (1871-1938), who went to America from England, made instinct (later referred to as propensity) a central topic in his system of psychology from 1908. Nikolaas Tinbergen (1907-) believes that it is impossible to account for the behavior of animals without making use of the concept of instinct. Current emphasis upon instinctual drives, popularized by the Freudians, has also given rise to the opinion that many American psychologists were too hasty in abandoning the concept. It should be noted, however, that contemporary animal psychologists who have reinvented the concept are inclined to give broad and ambiguous definitions for the term. Tinbergen, for example, who is thoroughly familiar with the research of contemporary European psychologists does not attempt to define instinct until he is halfway through his book. The Freudians, it should be noted, have a specialized definition for the term, and they are uninterested in the traditional discussions of James and others about instincts and their place in animal and human behavior.

Consult Bernard, Luther L., *Instinct* (New York 1924); Tinbergen, Nikolaas, *The Study of Instinct* (New York 1951).

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INSTITUT DE FRANCE, ăN-stê-tû' dē frāns, official name for five learned societies in France: (1) Académie Française; (2) Académie des Inscriptions et Belles-Lettres; (3) Académie des Beaux-Arts; (4) Académie des Sciences; (5) Académie des Sciences Morales et Politiques. The institute had its origin in the old royal academies founded during the 17th and the 18th

centuries. These academies were suppressed during the French Revolution and the Institut de France took their place, being formally established by the Constitution of 1795, which reads in part: "There is for the Republic a National Institute, entrusted with the care of collecting records of all discoveries and furthering the progress of arts and sciences." The foundation's charter admitted only three sections: (1) Sciences Physiques et Mathématiques; (2) Sciences Morales et Politiques; (3) Littérature et Beaux-Arts.

The Institut de France was inaugurated in the Louvre on April 4, 1796. The ceremony was attended by the state ministers, the foreign ambassadors, and eminent Parisians. As Raymond Poincaré stated a century later: "Public homage was paid on that day to the unity of sciences by a rejuvenated nation." The scientists Lamarck, Georges Cuvier, Gaspard Monge, Pierre Samuel Dupont de Nemours, Claude Louis Berthollet, Jean Antoine Chaptal, Antoine Laurent de Jussieu, and the comte de Volney, as well as Napoleon Bonaparte, the sculptors Jean Houdon and Augustin Pajou, and the painter Jacques Louis David were among the first members of the new organization. Later Napoleon Bonaparte, when first consul, gave a special uniform to the members of the institute. When he became emperor he turned over to the institute the buildings of the old College of Nations, on the left bank of the Seine, opposite the Louvre. It took the name of Palace of the Institute. The name "Academy," suppressed by the Convention, was revived by Louis XVIII in 1816, after the downfall of Napoleon. Thenceforth the institute was composed of the five academies assembled. It has 231 members and 296 correspondents. Some of the correspondents are from various European nations, and some are Americans.

After the death of a member his seat is declared vacant. Candidates must give notice of their candidacy to the academy in which they wish to stand for election, which takes place some time later. There is a further delay between the election and the ceremonial reception when the new academicien is formally admitted.

During the 19th and 20th centuries the institute was enriched by many gifts, donations, and legacies which provide for the distribution of prizes and the printing of publications. In addition to its own library, which has 500,000 volumes, the institute administers also the Bibliothèque Mazarine, founded by Jules Cardinal Mazarin, and owns the Bibliothèque Thiers and the Bibliothèque Marmottan, each of which is housed in the mansion of its former owner. The institute inherited the collection of manuscripts, documents, and rare books assembled in the course of the present century by Charles de Spoelberch de Lovenjoul for the study of French literature of his time. The institute is also proprietor of: (1) the Château de Chantilly, with its grounds, woods, and farms, given by the duc d'Aumale, together with his art treasures and library, which were turned into a museum, the Musée Condé; (2) the Musée Jacquemart-André, in Paris, settled in a private mansion and showing tapestries, paintings, furniture; (3) the Abbey of Chaalis, near Senlis; (4) Langeais, a château on the Loire: given by the Siegfried family; (5) the Paul Marmottan museum, in Paris, located in the mansion of the donor; (6) the Villa Ile-de-France, near Nice, presented by Baroness Ephrussi, with its collections of antiques and works of

Eastern art, and turned into a museum; (7) the House of the Institute of France, in London, Foundation Edmond de Rothschild, for French students. This house was bombed by the Germans during World War II, the director and other inhabitants of the house being killed.

Numerous annual prizes are distributed by the institute to writers, scientists, and artists, and some prizes are used to reward the most virtuous actions and the books which may best further the progress of morality.

Académie Française.—This was founded by Cardinal de Richelieu, minister to Louis XIII, in 1635, when Richelieu asked a few poets and writers whether "they would not care to be formed into a company under the authority of the state, for the purpose of working at the development, unification, and purification of the French language." They were to do their best to make it as perfect a language as Greek and Latin used to be. When they had accepted the proposition, with various degrees of enthusiasm, their first task was to prepare a dictionary, the first edition of which appeared in 1694. Members of the academy have continued preparing revised editions of this dictionary to the present day. New editions were published in 1718, 1740, 1762, in the year VII (1798) of the Republic, in 1835, 1877, and in 1932-1935.

Pierre Corneille, Jean Baptiste Racine, Nicolas Boileau, Jean de La Bruyère, Charles Perrault, Jacques Bénigne Bossuet, Valentin Esprit Fléchier, Bernard Le Bovier de Fontenelle, and Jean de La Fontaine were among the first members of the academy. Molière never belonged to it. On the other hand, many aristocrats, who had very little to do with erudition, found their way into this institution, which always enjoyed royal favor. During the 18th century Voltaire, Jean Le Rond d'Alembert, the marquis de Condorcet, and many of the other Encyclopedists were academicians. All the foreign monarchs and princes and the most illustrious visitors to Paris used to attend meetings at the academy. Following this tradition, Gen. John J. Pershing was solemnly received there during World War I. During the first part of the 19th century, when the romantic school of writers was at its height, the academy stood for tradition, and it took a long time for members of the new generation to be elected. Alphonse de Lamartine and Victor Hugo succeeded only after a long wait and many rebuffs.

Among the prizes distributed by the academy, the most important are: (1) *Prix de la langue française*; (2) *Grand prix de littérature*; (3) *Prix du roman*. Other prizes reward authors of books intended to improve morals, books on French history, the best new comedy played at the Comédie Française, and the best translation of a foreign book into French. Other prizes go to people who have led an exceptional, virtuous, and productive life and to people who have reached a high level of family, social, or moral perfection.

Membership in the Académie Française is limited to 40 at any given time. The following is a list of the members in 1965, with year of election given in parentheses after each name:

Marcel Achard (1956)
Louis Armand (1963)
Marc Boegner (1962)
Marcel Brion (1964)
Duc Louis de Broglie (1944)
Jérôme Carcopino (1945)
André Chamson (1956)

Jacques Chastenot (1956)
René Clair (1960)
Jean Delay (1959)
Georges Duhamel (1935)
André François-Poncet (1952)
Maurice Garçon (1946)
Pierre Gaxotte (1953)

Maurice Genevoix (1946)
Étienne Gilson (1946)
Jean Guéhenno (1962)
Jean Guiton (1961)
Comte Robert d'Harcourt (1946)
René Huyghe (1960)
Marshal Alphonse Juin (1952)
Joseph Kessel (1962)
Jacques de Lacretelle (1936)
Duc de Levis-Mirepoix (1953)
Henri Massis (1960)
Thierry Maulnier (1964)

François Mauriac (1933)
André Maurois (1938)
Henry de Montherlant (1960)
Comte Wladimir d'Ormesson (1956)
Marcel Pagnol (1946)
Jean Paulhan (1963)
Jules Romains (1946)
Jean Rostand (1959)
Jacques Rueff (1965)
Cardinal Tisserant (1961)
Henri Troyat (1959)
Pasteur Vallery-Radot (1944)

At the time this table was compiled, there were two vacancies in the Academy membership for which successors had not been elected.

Académie des Inscriptions et Belles-Lettres.—This was created by Jean Baptiste Colbert in 1663 and was first called "The Little Academy," then "Academy of Medals," then "Royal Academy of Inscriptions and Medals" in 1701. Its present name dates from 1716. Suppressed by the revolution, it revived when the institute was created. The Académie des Inscriptions et Belles-Lettres is mainly interested in historical studies and investigations concerning numismatics, ancient documents, and inscriptions in living and dead languages. It awards numerous prizes for historical research every year. With its 55 members are 12 foreign associates and 70 correspondents, 30 French and 40 of other nationalities. Correspondents from the United States include Lynn Thorndike, William F. Albright, Albrecht Goetze, and Elias A. Lowe.

Académie des Beaux-Arts.—This was created in 1648 by Charles Le Brun, appointed first painter to the king by Louis XIV. The name of this academy was then "Royal Academy of Painting and Sculpture." Its present name dates from 1795. For many years the academicians held their meetings in the Louvre. There are 41 members who are divided into five sections: painting, sculpture, architecture, engraving, and musical composition. A school governed by the Académie des Beaux-Arts was founded in Rome in 1666 to help French artists in their studies of antique and Italian arts. It is located in the Villa Medici. The academy also administers the École des Beaux-Arts in Paris. Before the French Revolution it was the only academy to admit women to membership. One of the last women elected was Marie Vigée-Lebrun. Its first American associate was Benjamin West. John D. Rockefeller, Jr., became one of the 10 foreign associates. Among the 50 correspondents of the Académie des Beaux-Arts are the Americans Paul Manship, for sculpture, and Welles Bosworth, for architecture.

Académie des Sciences.—Created by Colbert in 1666, this academy has 76 members, 12 non-residents, 6 members for the application of science to industry, 20 foreign associates, and 120 correspondents, divided into two groups: (a) mathematics and physics, (b) chemistry and natural history. These two groups are divided into 11 sections: geometry, mechanics, astronomy, geography and navigation, physics, chemistry, geology, botany, zoology, rural economy, and medicine and surgery. Benjamin Franklin was a foreign associate of this academy, as was Albert Einstein. The Académie des Sciences started distributing prizes as early as 1721, and since that time the number of prizes awarded has steadily increased. One of the latest prizes was

founded by Prince Albert I of Monaco.

Académie des Sciences Morales et Politiques.—Founded in 1795 and named "Classe des Sciences Morales et Politiques," it was suppressed in 1803 by Napoleon, who appreciated neither its inquisitive spirit nor the comments and criticisms of the academicians on political matters and social controversies. It was restored with its present name in 1832 and joined the four other academies. It is divided into five sections: (1) philosophy; (2) morals and sociology; (3) legislation, public law, and jurisprudence; (4) political economy, statistics, and finance; (5) history and geography. In addition to 40 academicians there are 60 correspondents, 10 free members, and 12 foreign associates including President Dwight D. Eisenhower, elected to General Pershing's seat.

Bibliography.—Aucoc, Léon, comp., *L'Institut de France* (Paris 1889); Franqueville, Amable C. Franquet de, *Le premier siècle de l'Institut de France*, 2 vols. (Paris 1895); Boissier, Gaston, and others, *L'Institut de France*, 2 vols. (Paris 1908); Derrouch, André, *L'Institut de France* (Paris 1938); Derrouch, André, *L'Institut de France, son statut juridique* (Paris 1938); *La Documentation Française—Notes et Etudes Documentaires 2032*, *L'Institut de France* (Paris 1955).

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INSTITUTE FOR ADVANCED STUDY, The, in'stī-tūt, located at Princeton, N.J. Originally conceived as a graduate school with a faculty which would have no undergraduate obligations, the institute has actually been from its start a research center for eminent scholars doing advanced work in their fields of specialization. Although it relies heavily upon the facilities of Princeton University, it is a completely separate organization. No degrees are awarded, as all members are required to have the highest degrees in their respective fields in order to qualify for the institute. In 1956 there were two schools at the institute, one for mathematics and one for historical studies. There were about 40 long-term members, of whom approximately half were members of the faculty. In addition there were about 100 temporary members in residence for short terms of one or two years. Admitted by faculty vote, many of these members are invited to the institute in the belief that their participation will be of mutual benefit to them and to the long-term members. Applications for admission are also accepted.

The Institute for Advanced Study was founded in 1930 by Louis Bamberger and his sister, Mrs. Felix Fuld, with a donation of \$5 million, and it opened in 1933 under the directorship of Abraham Flexner. Flexner was succeeded as director in 1939 by Frank Aydelotte, and Robert Oppenheimer became director in 1947.

INSTITUTE OF INTERNATIONAL EDUCATION, established in 1919 by Nicholas Murray Butler, Elihu Root, and Stephen Duggan "to enable our people to secure a better understanding of foreign nations, and to enable foreign nations to obtain accurate knowledge of the United States, its people, institutions and culture." It is a private, nonprofit agency which acts as a clearinghouse for information on all phases of international education and administers exchange-of-persons programs—including the Fulbright program for graduate students—for government agencies, foundations, organizations, col-

leges and universities, and corporations in the United States and abroad. Each year over 4,500 students, teachers, technicians, and specialists study or train in a country other than their own through institute programs. Through its New York City headquarters and its regional offices in Chicago, Denver, Houston, San Francisco, and Washington, D.C., the institute works to bring foreign students and visitors into closer contact with the American community. With the cooperation of regional committees these offices arrange home hospitality, field trips, and recreation programs for visitors from abroad.

As a public service the institute's Department of Information answers requests for information and counseling on all phases of international education: scholarship opportunities, fields of study in the United States and abroad, opportunities for teachers and specialists. It issues publications, maintains a library with catalogues of most institutions of higher learning in the United States and abroad, and provides information concerning other organizations in the field of international education. The institute has also developed the Central Index of Educational Exchangees, a roster of more than 250,000 persons who have studied, taught, or trained in countries other than their own since 1919.

The institute seeks to provide coordination in the field of international education by sponsoring conferences and meetings bringing together interested individuals from education, government, business, labor, the arts, and religious and civic groups. It offers program guidance in the form of information on current activities in specific fields or geographic areas, and gives counsel based on experience with specific operations, such as the selection of candidates, fiscal management, or the placement of foreign students, to organizations, institutions, and corporations interested in establishing new programs.

INSTITUTES OF ORATORY, a treatise by Quintilian (Marcus Fabius Quintilianus), the famous Roman rhetorician (35?–100 A.D.). *Institutes of Oratory* is the traditional English title, but more correctly it should be *Oratorical Education* (Latin, *Institutio oratoria*). Quintilian published it in 12 books (c. 95 A.D.) after some 20 years' rich experience of successful instruction in oratory at Rome. Though much of the treatise is highly technical, it still has great interest as a lasting monument of Roman genius in treating practically a subject whereon Greek genius abstractly theorized.

Book i discusses an orator's training and contains penetrating observations on pedagogy; its later chapters on language are important to students of Latin. Book ii treats of the several rhetorical schools, the declamations (which played a prominent part in instruction), and the nature and value of oratory. Books iii–ix are rather technical, devoted to kinds of oratory, types of causes, formal structure of a speech, proofs, syllogistic arguments, emotional appeal, style, propriety of words, ornament, figures of thought and of speech, artistry, and rhythm. Book x reviews Greek and Latin literatures from the rhetorical viewpoint and is of prime worth for critics of classical literature. Book xi explains memory and mnemonics and discusses delivery, gesture, and attire. Book xii treats higher themes: importance of character, educative value of philosophy and of law, oratorical ideals, appropriate use of dif-

ferent oratorical styles, and advantages derived from successful training as an orator.

The best Latin edition with English translation is by Harold E. Butler, *The Institutio Oratoria of Quintilian*, 4 vols. (London 1921-22).

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INSTITUTES OF THE CHRISTIAN RELIGION, *The (Christianae Religionis Institutio)*, treatise by John Calvin (q.v.) published in the original Latin at Basel, 1536. His first French version (1541) is a landmark of French prose. Intending it as a short clarification of Protestant doctrine for believers, Calvin kept revising and enlarging; the original six chapters eventually grew to four books (Lat. ed. 1559; Fr. ed. 1560).

INSTITUTIONS, *Social*, in-stī-tū'shūnz, one of the fundamental categories of modern sociological science. Full agreement on the definition does not, however, exist among specialists. One conception is that an institution should be defined as a *complex of norms* regulating the actions of persons in the process of social interaction. A typical example is the institution of property, regulating behavior where the acquisition, use, control, and disposal of objects of possession are concerned. Though the objects may be physical, property essentially defines the rights and obligations of people in relation to each other where such objects are involved. Another typical example is authority, which is a complex of norms regulating behavior conceived to be necessary to the attainment of the common goals pursued in a collectivity. A central aspect of authority is the right to impose and obligation to accept binding decisions, the enforcement of which may involve coercive sanctions.

The principal alternative to the above definition is the concept which identifies an institution with a group or collectivity; thus a university or a hospital or even the military establishments may be referred to as an institution. In such usage the term is likely to be reserved for relatively large and formalized collectivities, sometimes referred to as *formal organizations*.

For many purposes close to the level of common sense the difference between the two is not vital, but for more refined analytical purposes it becomes important because the same institutions characterize many different collectivities which differ from each other in other respects. Thus the same institution of property applies to business corporations, private nonprofit organizations, and even in some respects to government agencies. The same institution of contract obtains, for example in the field of employment, within considerable limits, whatever the character of the organization. At the more formalized level in modern societies, the law is the focus of the definition of institutions.

An institution, it has been indicated, regulates action. Detailed prescription is only one aspect of that regulation. In general, besides prescriptions, an institutional complex will incorporate prohibitions—that is, it will define the limits of acceptable behavior; and between these two there will be a range of permitted behavior which is neither prescribed nor prohibited. Within the permitted range negative sanctions or punishments will not be applied, but there may be differential rewards for different levels of approved performance.

Thus where the obligation to complete a secondary education may be said to be institutionalized, as it is for certain population groups, "passing" work may be satisfactory, but special rewards will be given for excellence; "failure," however, will be definitely punished, at the least by disapproval. Different institutions vary greatly, both in the same society and from one society to another, in the relative emphases on these three components of the definition of rights and obligations.

Institutions are aspects of the structure of social systems. A cognate concept of process, *institutionalization*, is also common. This refers to the process by which a norm or a pattern of behavior has come to be expected of those occupying given statuses in a society—the extent to which the type of behavior in question comes to be "done," in the normative sense, in the society. So far as this is the case, the tendency will be (1) for behavior in conformity with the norm to be rewarded by others with whom the individual interacts, and for deviation from the norm to be punished; and (2) for the institutional "role-expectation" to become internalized—the individual, as part of his psychological structure, will want to do what he is expected to do. Thus in a society which values achievement in occupational roles, "ambition to succeed" is the internalized counterpart of the institutionalized expectation of high occupational performance. In this sense institutionalization is a matter of degree; for example, both external sanctions on achievement and internalized commitment to it vary greatly in different population groups.

Institutions in the present sense constitute the most important category for the analysis of variations in structure as between different societies and, correspondingly, in the structure of the same society at different times. Thus the modern institution of ownership as a form of property is very different from the medieval patterns of tenure. Bureaucratic authority in the modern business firm is very different from the purportedly divine authority of the Hebrew prophets or the authority of such political leaders as Adolf Hitler. The technical classification of institutional patterns is the main framework for the analysis of social variability.

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INSTRUMENT OF GOVERNMENT, in'strōō-mēnt, the first written constitution in English history. Under it Oliver Cromwell governed England, Scotland, and Ireland from Dec. 16, 1653, to May 1657. It consisted of 42 articles and vested the legislative power in the hands of "one person and the people assembled in parliament." The executive power was placed in the hands of Cromwell as lord protector of the Commonwealth; his office was made elective, and he was to be assisted as executive by a council of state of 21 members, appointed for life. The Parliament was to consist of a single chamber. A new Parliament was to be called every third year, and a Parliament could not be dissolved in less than five months except with its own consent. There were 460 members—400 for England and Wales and 30 each for Ireland and Scotland. The distribution of borough seats was improved, and the property qualification for voters in the counties was changed from the 40 shilling freehold to ownership of land or personal property of the value of £200.

Roman Catholics and those who had opposed Parliament during the Rebellion were disfranchised. This constitution contained several elements of weakness and its downfall was assured as soon as it dared assert its independence of or opposed the lord protector.

Consult Gardiner, Samuel Rawson, *Constitutional Documents* (Oxford 1889); and Jenks, Edward, *Constitutional Experiments* (London 1891).

INSTRUMENTAL MUSIC. See MUSIC; MUSICAL INSTRUMENTS; ORCHESTRA MUSIC.

INSTRUMENTALISM, in philosophy, a system, akin to pragmatism, according to which thought is considered an organic function, the object of which is to maintain the even tenor of experience, restoring the latter when it is interrupted or confronted by a special situation. See EPISTEMOLOGY; PRAGMATISM.

INSTRUMENTATION, in music, the arranging of music for a combined number of instruments. The nature and character of the musical ideas must determine whether the instrumentation shall be simple or artistic, and perhaps complex; the latter being the case when some of the instruments take a more prominent part than others. For both purposes, a thorough knowledge of every instrument in the orchestra is absolutely necessary, as without this instrumentation becomes only a deafening mass of sounds. The stringed instruments, from their nature, in most cases, form the principal parts of a score, around which the other instruments move, without depriving them of their importance. The wind instruments represent, more or less, a subordinate chorus, which may again be divided into two kinds: the wood instrument and the brass, which, with the stringed instruments, give three essentially different choral effects, that may be mixed together in endless variety. A knowledge of the art of instrumentation is acquired only by great experience; at the same time much may be learned by consulting the best works on the subject such as Berlioz, Louis Hector, *Traité d'Instrumentation*; Gassner, Ferdinand Simon, *Partiturerkenntnis*."

INSTRUMENTATION. The drive for mass production in industry initiated by World War II stimulated the drive for the development and use of instrumental methods of chemical analysis. The trend has been along three distinct lines: (1) Application of recent electronic developments toward the manufacture of commercial instruments to measure well-known physical properties with a precision and rapidity hitherto unattainable; (2) the automatizing of single- and multiple-unit operations either to record automatically specific physical characteristics or both to record and control as in the case of temperature regulation or by actuating valves for introduction of reactants; (3) the development of new techniques, notably ultramicroscopic and radioactive tracer methods.

Most notable developments have been in the spectrophotometric field, both in emission and absorption spectroscopy, and cover almost the entire range of measurable electromagnetic radiations. Although well-known since the time of Robert Wilhelm Bunsen, the science of emission spectroscopy has not been extensively applied to routine industrial control problems until the last decade. During this time the spectrograph has

developed from a relatively simple light-resolving instrument, useful for qualitative work but of relatively minor importance for quantitative estimations, to a complex electronic device which permits the rapid (one to two minutes) precise estimation of multiple constituents. This has been particularly useful in the metallurgical field for the rapid testing of minor constituents in aluminum, magnesium, steel, and other alloys. A typical example is the Quantometer, a grating-type instrument, which not only resolves the spectrum excited by an aluminum spark, but which simultaneously measures the relative intensities of specific lines for as many as sixteen elements which are usually present in relatively small amounts. By previous calibration, the intensities of the specific lines actuate counters so that the actual percentage of each of the elements may be directly read from the instrument as soon as the spark discharge (30 to 120 seconds) stops. Thus, the analytical control work for a melt of aluminum which used to require days of painstaking wet chemical analyses is accomplished in a matter of minutes. Such a development could not have been accomplished except for the development of highly sensitive and stable electrical components. These are essential for a consistent power supply, as well as for the measurement of the low level light intensities involved.

By the use of quartz optics and photocells sensitive to low levels of ultraviolet radiations, highly precise and rapid quantitative absorption work is now possible in the ultraviolet region of the spectrum (notably from 2100 to 3500 Å). The Beckman DU model spectrophotometer has given great impetus to this field by making generally available an instrument which is stable and relatively easy to operate and which permits either absorbancy or per cent transmission measurements at highly monochromatic wavelengths with great rapidity and with a precision of one per cent. Thus, it is now possible to use ultraviolet absorption bands of substances not only for identification purposes, but also for highly precise quantitative measurements. This technique has been of particular value in the field of organic chemicals, notably in the fields of pharmaceuticals and dyestuffs.

A recently marketed double-cell instrument which uses photomultipliers and which automatically scans the entire ultra-violet (U.V.) region, comparing a sample in solution against a solvent blank, now enables the chemist to chart accurately the U.V. spectrum of a compound in a matter of two to ten minutes depending upon the detail desired. In such an instrument the slit width is automatically controlled simultaneously with the wavelength drive so as to obtain maximum resolution and optimum sensitivity at each wave length. For such instruments, hydrogen discharge lamps serve as continuous energy sources.

In the visible region of the spectrum many precise and direct reading photoelectric spectrophotometers are available including filter type, replica grating, and glass prism-type instruments. The filter type are the simplest in construction; because of their ruggedness and relatively low cost, they are used most widely for routine control work. These instruments have largely replaced the visual-type colorimeters which were so very dependent upon the individual operator's eyesight and personality.

The availability of commercial instruments applicable to the infrared region of the spectrum now permits this region to be used widely. Relatively simple single-purpose instruments are in common use for controlling gas streams or for measuring the change in concentration of a single component. For general survey work over large portions of this region of the spectrum, instruments with sodium chloride prisms, lenses, and cell windows are being widely used in the 1.5 to 15.0 micron region. Other optics, such as potassium bromide and silver iodide, have extended the useful region up to 25.0 microns. These instruments are now widely used for the characterization of compounds—the infrared spectrum of each substance being sufficiently complex so as to be likened to a "fingerprint" of the substance. The ability specifically to identify definite groups within the molecule, namely nitrate groups, sulphate groups, and others such as $C-O-C$, $C=C$, $C=O$, free $O-H$, $N-H$, is making this technique of particular value to synthetic organic chemists. In the petroleum field, distillate composition is being rapidly controlled by absorbency measurements at different wavelengths, each more or less specific for a definite component, followed by calculations involving the solving of simultaneous equations so as to yield quantitative data for each constituent. The simultaneous determination of four component systems is commonplace, and as many as eleven and twelve component systems may be resolved in this fashion. This development has been made possible by the availability of electronic computers since the manual solution of simultaneous equations involving four, five, six, and more unknowns would be economically impossible because of the man-hours of calculations required.

For routine survey use in the infrared region, both single- and double-beam instruments are commercially available. Either Nernst glowers or globar elements are used for energy sources with bolometers or thermocouples being used as pickups. Since direct currents of very low energy levels are involved, suitable precise measurement has been a problem. A common practice in use is to employ a beam chopper in the light path so as to convert the direct current to a pulsating current which may then be handled like alternating current for amplification. A recent innovation permits direct transmission readings in a single-beam instrument. In this instrument a solvent blank is initially scanned, the slit width being automatically adjusted to give 100 per cent transmission over the region being investigated. The necessary slit-width settings are automatically recorded on a wire recorder, and when a sample is then placed in the path, the wire recorder continuously adjusts the slit width so that it becomes possible to obtain a differential absorbency curve (of sample versus solvent). Some of the advantages of such a system include measurement of the sample in the same cell as the blank and the lack of necessity of having two perfectly balanced beams. Such an instrument is, of course, dependent upon its electrical stability between runs and its sensitivity to line voltage fluctuations.

The development of sensitive flame photometers permits rapid determinations of potassium, sodium, lithium, and other elements by atomizing the sample into a hot gas flame and measurement of the intensity of specific lines energized therein. Sensitivities down to 0.1 parts per million by this technique are now commonplace.

The two major war products, radar and atomic energy, have introduced radical changes in the laboratory. The atomic energy project, of course, is now making available to the chemist radioactive elements which were never available before and which can be used for "tracer" techniques. A whole new field of instrumentation has been introduced for these "tracer" studies by the construction of rapid and sensitive Geiger-Müller counters, scaling, and recording units.

In fields other than the photometric, progress has been also outstanding. The really first new developments in the construction of an analytical balance in 50 years have resulted in a direct reading balance which operates under constant load, and thus constant sensitivity, and enables direct weighing of substances with a sensitivity of $\frac{1}{20}$ of a milligram (total load 200 grams).

The glass electrode is now universally used both for the measurement of pH and for the automatic control of acidity. New glasses have permitted the manufacture of sturdy, heavy-walled and sensitive electrodes applicable over a wide temperature range and useful at high pH values.

Automatic titration assemblies are now readily available which carry out either electromotive force type titrations (acid-base, oxidation-reduction, and precipitation type reactants) or polarization type ("dead stop") titrations automatically. In these instruments a measured sample is added to a suitable titration vessel, the instrument is set for the desired endpoint, and the titrant is then automatically added until this endpoint is reached.

The use of the polarographic technique is being advanced along two lines. Recording instruments (either pen and ink or photographic) are now available which automatically trace a polarographic curve, using the dropping mercury electrode, over any desired voltage range. On the other hand, the rotating platinum electrode is being used for amperometric titrations at fixed voltages. With the advent of standardized diffusion current constants, it is necessary that the rate of flow of mercury, m , from the dropping mercury electrode be known precisely. For this purpose an automatic mercury-measurer is now available.

High-frequency induction-type furnaces have been introduced, primarily for the determination of carbon and sulphur in steels. In these furnaces the power consumption is relatively low since it is only in use during the actual combustion of the sample. High-frequency oscillator circuits have also been introduced to carry out electrodeless titrations. Primary applications have been to halogen titrations.

The mass spectrograph is being commercially utilized primarily for the analysis of multicomponent hydrocarbon mixtures although its original use for the separation and measurement of mass isotopes continues.

The field of extraction is now playing a very important part in the separation of closely related rather complex substances. This has made itself felt by a host of workers in the field of counter-current distribution studies wherein a solute is permitted to come to equilibrium between two immiscible solvents. As a result, rather complex mechanisms have been devised to permit continuous stage countercurrent distribution studies by automatic robots.

In the field of gas analysis many specific physical measurements are being utilized for au-

tomatic control. A magneto-acoustical system is in commercial use for the detection of a few hundredths of a per cent of oxygen. Interferometric methods are in use for the analysis of nitrogen-argon mixtures. Manometric methods for many gases permit automatic recording of the pressure involved. A very sensitive differential manometer which can detect differences as low as 0.000001 atmosphere over a range of 1 mm. of mercury to 1 atmosphere depends on the principle of the aneroid barometer. The measurement depends upon the motion between a pair of nesting diaphragms which are soldered together to form a very thin capsule containing the gas or vapor. One diaphragm remains stationary and the second is attached to a displacement gage with the four resistance wires serving as a Wheatstone bridge.

Viscosity measurements of liquids are now largely based on measurement of the torque exerted on a rotating stirrer. A wide range of viscosities may be measured by using different sized or shaped spindles, paddles, or disks, together with various strength torque springs. This procedure lends itself to automatic recording.

Electrical titration methods are generally limited in their use by the nature and sensitivity of the electrodes used. Recently, the introduction of high-frequency oscillator titration circuits has permitted titrations without any electrodes being immersed in the titration cell. Three factors govern the characteristics of an oscillator which includes a liquid or solution in its tank circuit. These factors include the circuit constants of the oscillator, the volume of the solution and its location in the circuit, and the conductance of the solution as affected by its ionic or dipole concentration. The changes in conductance during a titration cause variation in such loading and thereby permit the course of a titration to be precisely followed without electrodes being actually immersed within the solution. This new method of analysis thus utilizes the energy absorption from a high frequency field as the basis of a new conductometric method of analysis. Wide use of this technique is being made in the determination of chlorides in water, especially as related to the petroleum field. It will undoubtedly be applied to other fields and other types of titrations as chemists become familiar with the principles.

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INSTRUMENTS, Electric Measuring.
See ELECTRICAL MEASUREMENTS.

INSTRUMENTS, Musical. See MUSICAL INSTRUMENTS.

INSUBRES, a Celtic people of northern Italy. In the 4th century B.C. they settled in the region between the Alps and the Apennines. They were frequently at war with the Romans after 222 B.C., and in 194 their capital Mediolanum (Milan) was taken and they were finally brought under the yoke of Rome.

Consult Holder, A., *Alteltischer Sprachschatz*, vol. 2 (1904).

INSULAR CASES, a series of legislative problems created by the "accretion" to the United States of insular possessions following the Spanish American War in 1898. They arose over

Pres. William McKinley's recommendation in his message on the convening of the 56th Congress, Dec. 3, 1899, that "legislation should be enacted establishing a civil government in Puerto Rico," and involved the status of the citizens of our insular possessions and the constitutionality of an intra-national revenue tax. The Foraker Act, April 11, 1900, defined the relation of the island to the United States, by placing it on a status outside of the Constitution and also outlined a scheme for the government of dependencies that obligated the nation to a new and united policy. This gave rise to the Insular Cases which debated the question of the right to demand duty for commercial articles imported into the United States from Puerto Rico. On appeal the Supreme Court decided that the insular possessions were obtained under the clause regulating the making of treaties, and "that the power to acquire territory by treaty implies not only the power to govern such territory, but to prescribe upon what terms the United States will receive its inhabitants, and what their status shall be."

INSULATION. From the generation of electricity to the use of electricity, the two fundamental materials required (not including magnetic materials) are conductors and insulators, the one being as important as the other. Electrically speaking, all material may be divided into two general classes, conductors and insulators, depending upon their relative resistance to the flow of electricity. Conducting materials must have low resistance; and insulating materials, high resistance. Insulating material is required where mechanical contact is made by the conducting material. From an economic standpoint, conducting material is limited to copper and aluminum, but for insulating purposes many materials are available.

Insulation resistance is the resistance of the material to the passage of current. It is proportional to the thickness of the material (if the material is homogeneous), and inversely proportional to the area. Insulation resistance is measured in ohms, or in megohms (1 megohm = 1,000,000 ohms).

Dielectric strength is the strength against breakdown under electric stress. It is usually expressed in terms of the voltage per unit thickness (usually volts per mil) at which the insulation fails or becomes punctured. It does not vary with area, but increases when the thickness increases.

The output rating of a piece of electrical equipment is limited by the temperature its insulation can withstand without excessive deterioration. Common types of organic insulation, such as cotton, silk, linen, and paper, rarely permit a rated temperature rise greater than 55°C. (131°F.) over an ambient temperature of 40°C. (104°F.). Where higher temperatures are unavoidable, asbestos can be used if the attendant space factor is not prohibitive, and if the low tensile and dielectric strengths are not of great importance. Mica had been employed extensively, but its lack of mechanical strength and its high cost have imposed certain limitations on its use. The maximum operating temperature of electrical apparatus is now limited only by the qualities of the impregnant used.

Electrical Insulating Material.—The selection of insulating material depends upon several

factors, such as low power factor, high dielectric and mechanical strength, flexibility, and resistance to heat, abrasion, moisture, and deterioration. Porcelain is a good insulator which possesses practically all the foregoing characteristics except flexibility. Rubber, on the other hand, is flexible but will not stand heat or abrasion. The most widely used insulating products are combinations of several materials, such as mica, paper, and varnish. Paper, for example furnishes the base upon which mica is fastened by means of varnish; the combination possesses good dielectric strength, flexibility, and resistance to moisture.

CLASSIFICATION OF INSULATING MATERIALS

Thermal Classification.—Insulating materials are divided in this category into four classes: Class O, Class A, Class B, and Class C, which are thus defined by American Institute of Electrical Engineers standards.

Class O.—This insulation consists of cotton, silk, paper, and similar organic materials not impregnated with, nor immersed in, oil. The temperature limitation is 85° C. (185° F.).

Class A.—This group includes cotton, silk, paper, and similar organic materials impregnated with, or immersed in, oil; also enamel as applied to conductors. The temperature limitation is 125° C. (270° F.).

Class B.—This category includes inorganic materials, such as mica and asbestos, in built-up form combined with binding substances. If Class A material is used in small quantities in combination, for structural purposes only, the combined material may be considered as Class B, provided that the electrical and mechanical properties of the insulated winding are not impaired by the application of the temperature permitted for Class B material. Temperature limitation is 145° C. (293° F.).

Class C.—This insulation consists of inorganic materials, such as pure mica, porcelain, slate, glass, and quartz. There are as yet no stated temperature limits for these materials.

Physical Classification.—Insulation materials are physically classified as solids, liquids, plastics, varnishes and lacquers, and gases.

Solids.—In the group of solids there are: *natural solids* such as marble, slate, asbestos, quartz, mica, lava, soapstone, Alsifilm (ben-tonite); *vitreous solids* such as, glass, porcelain, and Mycalex (inorganic thermoplastic); the *fibrous* (treated and untreated) organic solids, including asbestos, cellophane, cotton, glass yarn, hemp, linen, nylon, paper, rayon, silk, and wood; and the *lastics*, which include buna, gutta-percha, koroisel, natural rubber, neoprene, thiokol, and ethylene polysulphide.

Liquids.—Among liquids used as insulation are *natural oils*, such as linseed, tung, pine, and castor, which are used in insulating varnishes, or in binders for built-up insulation; *mineral oil* (transformer and switch); *varnishes*; *synthetic liquids* (chlorinated derivatives of the benzenoid hydrocarbons) such as Pyranol, Inerteen and Dykanol "A," all of which are fireproof. Solvents are not used as insulation directly, but insulating varnishes and compounds include amyl and butyl acetates, acetone, alcohols, benzene, benzine, carbon tetrachloride, naphtha, petroleum, toluene, and turpentine.

Plastic Materials.—Several types of plastic materials are used for electrical insulation. The

gums or natural plastics include asphaltic, coumarone-indene, fossil, shellac, and vegetable (applied as liquids, melted, dissolved, or in liquid suspension). *Cold-molded plastics* include portland cement and filler, calcium silicate and filler—both impregnated with resins or asphalts; *waxes* used are beeswax, mineral, and paraffin. Two types of *synthetic resins* are used for insulation—the molded and laminated plastics, such as acrylic, alkyd, casein, melec, phenolic, resorcinol, formaldehyde, rubber, urea, formaldehyde and urea furfural, vinyl copolymers; and the cellulose compounds (therma plastics), such as cellulose acetate, cellulose acetobutyrate, ethyl, cellulose, and nitrocellulose.

Varnishes and Lacquers.—Insulating materials of this type are manufactured from natural gums and oils, and from synthetic resins. There are also hybrids; spirit varnishes, wire enamel, and solvent varnishes.

Gases.—Among insulating gases used in electrical insulation are air, carbon dioxide (CO₂), nitrogen (N₂), hydrogen (H₂), and rare gases such as helium, xenon, argon and krypton.

The properties and general characteristics of some of the insulating materials mentioned above are given in Table 1.

MATERIALS AND THEIR USES

A brief description of some of the best known insulating materials and of the way in which they are used is given in the following paragraphs.

Glass.—One of the oldest substances used for insulating purposes is glass. While the principal application of glass insulation has been for rigid insulators, recent developments have made it available in fabricated, flexible form.

Porcelain.—Like glass, porcelain is an excellent rigid insulator, but is not available in flexible form. Its principal use is for buildings, high voltage insulators, cleats, and bodies of wiring devices. Porcelain possesses high dielectric and fair mechanical strength, and is resistant to heat, moisture, and deterioration, but its lack of flexibility greatly restricts its use. Next to glass and cotton, it is the oldest of all insulating materials.

Slate.—This material is especially suitable for use wherever rigid insulating support is required for mounting switches and for control equipment. Slate, obtainable without metallic veins, has high insulation resistance and sufficient dielectric strength for all medium-voltage service, it cannot carbonize; thus in case of "flashovers," or electrical breakdown, it prevents short-circuiting. Slate is also resistant to heat, moisture, chemical fumes, and oils. In the early days of the industry, slate was used for switchboard panels. While it is still used for this purpose in limited quantities, substitutes are taking its place.

Marble.—This decorative material was once used for switchboards, especially in locations exposed to the public view. Its insulating characteristics are about the same as those of slate.

Mica.—Widely used as insulation is mica, an anhydrous silicate of aluminum and potash, or sodium, mined in the form of large laminated crystals. It is readily split into thin, tough, parallel-sided laminae, or flakes, with thicknesses as thin as 0.0008 mm. It has high insulation qualities and will withstand high temperatures. In its natural state, mica is impure, lacks flexibility, and has excessive surface leakage. Therefore the laminae are separated according to purity, and

TABLE 1—PROPERTIES OF INSULATING MATERIALS

Material	NEMA Temp. Class	Description	General Application	Usual Thickness	Dielect. Breakdown Volts per Mil
Cotton Tape	O, A		Coil finishing	0.005 to 0.015	20
Asbestos Tape	B		Coil finishing	0.007 to 0.015	20 to 70
Glass Tape	B		Coil finishing	0.003 to 0.015	96
Mica Tape	B	Built-up mica on paper or cloth	Armature coil winding	0.005 to 0.010	600 to 700
Kraft Paper	O, A	Tough brown paper	Layer insulation and wrappers	0.003 to 0.005	60 to 150
Glassine Paper	O, A	Glossy-hard translucent	Layer insulation	0.001 to 0.002	200
Varnished Paper	A	Varnish-treated paper	Layer insulation	0.002 to 0.005	900
Fish Paper	O, A	Extra-tough heavy paper	Pads, outer layer insulation	0.004 to 0.015	200
Asbestos Paper	B	Paper made of asbestos fibers	Layer insulation	0.010 to 0.025	20 to 200
Fish Paper and Mica	B	"Sandwich" of two materials	Wrapper insulation	0.010 to 0.020	400
Varnished Cambric	A	Varnish-treated cloth	Layer insulation and wrappers	0.007 to 0.010	1000
Varnished Silk	A	Flexible varnish-treated silk	Layer insulation and wrappers	0.002 to 0.004	1000
Flexible Mica	B	Built-up mica with flexible resinous binder	Terminal insulation and wrappers	0.010 to 0.060	500 to 600
Vulcanized Fiber	O, A	Chemically converted paper. Sheets and tubes.	Motor insulation and arcing resistance	0.005 to 2.000	50 to 350 ¹
Phenolic Laminated Plastic	A, B	Fabric or paper-reinforced resinous sheets, tubes and molded shapes.	Severe service insulation	0.015 to 8.000	75 to 750 ¹
Cotton Yarn	O, A	Multiple and ribbons	Wire covering, coil insulation	0.0020 to 0.010	90
Silk Yarn	O, A	Multiple and ribbons	Wire covering	0.0007 to 0.010	140
Glass Yarn	B	Multiple and ribbons	Wire covering	0.0007 to 0.010	200
Enamel	A	Film on wire	Wire covering	0.0001 to 0.0012	500

¹ Depending upon thickness (inversely proportional).

are cemented together to form flexible plates of any thickness.

The two kinds of mica most generally used for insulating purposes are: (1) Muscovite, usually called white or India mica, and (2) phlogophite, generally called amber mica. White mica withstands temperatures up to 500° C.; and amber mica, up to 800° C.

Mica, probably the most valuable insulating material in general use, has the following characteristics: (1) high insulation resistance; (2) high dielectric strength; (3) High mechanical strength; (4) Good flexibility; (5) low moisture absorption; (6) Comparatively good heat conductivity; (7) Low deterioration from heat; (8) Excellent resistance to acid; (9) A specific inductive capacity, or dielectric constant, from 4 to 8; (10) Low dielectric loss or power factor (2 to 5 per cent).

Thin paper or cloth backing for mica, with a bond of shellac, asphalt, or synthetic resins, make possible flexible mica in the form of tape, coil wrappers, and tubes. For hot or cold molding, white mica may be bonded with a thermoplastic material. Mica can be used in conjunction with other insulating materials, such as fish paper, rope paper, or kraft paper, for sheet insulation, or for special purposes.

Asbestos.—When used for insulation purposes, asbestos generally takes the form of paper or paper tape, asbestos millboard, or asbestos lumber, and in such forms it may contain from 10 to 20 per cent of wood pulp and glue, which give it strength. Chrysotile asbestos can be spun and made into asbestos cloth or cloth tape, which usually contains about 14 per cent cotton. Selected long-fiber material is made into 100 per cent asbestos twine.

While asbestos is a very poor electrical insulator, it is excellent for absorbing insulating compounds. When dry and properly treated, is valuable for high temperature insulation, and for the dissipation of corona in high-voltage apparatus. It is also one of the few fabrics that

cannot be destroyed by termites. Flexible cords used with domestic heating appliances, such as flat irons, have an asbestos covering between the rubber insulation over the conductors and the outer braid. This construction makes the cord fire resisting.

Fibreglas.—This electrical insulating material is woven from two kinds of yarn: continuous filament, and staple fiber. Continuous filaments, or fibers, are produced by mechanical drawing of the molten glass into fibers of great length (measured in miles); they have a general resemblance to natural silk or rayon in the manner in which they are later processed. Staple fibers are produced by steam drawing of molten glass into fibers varying from 8 to 14 inches in length, which have a general resemblance to cotton or worsted fibers.

Both fibers are inorganic, incombustible, durable, nonabsorbent, and relatively nonhygroscopic—properties commonly associated with the glass from which the fibers were made. In addition they are resilient, extremely flexible and have extraordinary unit tensile strength, exceeding that of the strongest piano wire—properties peculiar to glass in the form of fine fibers.

Fibreglas cloth is used as a base in the fabrication of varnished cloth, or cambric, and as a backing for mica. It is available in full cloth width, or cut into narrow tapes. A complete line of Fibreglas-mica cloths and tapes is also available.

Fibreglas also serves as a base for material of laminated products, available in a variety of thicknesses which can be machined or formed into intricate shapes as required. All Fibreglas products are used for electrical insulation in the same manner as any standard textile product.

Fibreglas electrical textiles successfully withstand temperatures in excess of 1,000° F. without impairment of their electrical properties, and they withstand temperatures in the neighborhood of 650° F. before losing their original flexibility and resiliency.

Individual glass fibers are relatively nonhygroscopic and nonabsorbent—properties of major importance in many electrical applications. Fibreglas electrical insulation is resistant to external abrasion, and to attack by moisture, acids, oils, and most corrosive vapors. The high insulation resistance (the ability to resist the flow of current through or over the surface of an insulating material) of Fibreglas impregnated tapes is substantially in excess of that of cotton or asbestos materials of similar character.

Because Fibreglas electrical yarns and tapes combine high temperature resistance, exceptional electrical properties, and great tensile strength, they permit the design of many types of electrical equipment in which the amount of insulation material used is substantially reduced.

Cotton.—Like all other organic materials, cotton is not adapted to the high-temperature applications which inorganic materials satisfactorily withstand. However, cotton is widely used for electrical insulating purposes in various forms of fabrics. Such fabrics are usually processed with different varnishes, gums, or compounds. Some of these composite materials have highly valuable insulating properties.

Untreated materials are used to a great extent for oil-type transformer insulation. They are thoroughly dry when immersed in the oil, which rapidly impregnates all fibers, resulting in an insulating material acquiring excellent physical properties from the cotton and dielectric strength from the oil.

The fundamental Class A materials are treated, or "pretreated" fabrics, of which there are numerous varieties. The two kinds in most common use are tan-linsed oil, or tung oil varnish-treated cloths; and black varnish, and asphaltum or bitumen compound treated cloths.

When tested in sheet form between two-inch circular electrodes, the instantaneous breakdown voltage of the tan-varnished cloth will usually be not less than 1,000 volts per mil; of the black cloth, 1,200 volts per mil.

Silk.—The insulating properties of silk are about the same as those of cotton. Because of its strength and smooth finish, silk is used principally to insulate magnet wire. Its cost is higher than that of cotton, and it is not generally used, except where space is an important factor, silk materials being thinner than cotton.

Adhesive or Friction Tape.—This cotton fabric insulating material is treated with a viscous rubber or bitumen compound; it is not often used as insulation for electrical apparatus, except in coil end connections of low-voltage induction motors, where it is completely covered with varnish or shellac. When fresh and in good condition, it may possess a dielectric strength of about 100 volts per mil, but it deteriorates rapidly when exposed to air.

Insulating Paper and Pressboard.—These materials are used extensively for insulating purposes in some types of electrical equipment such as transformers, circuit breakers, motors, and generators. However, for such insulating purposes, special papers not subject to rapid deterioration are required. These papers are made from pure cotton rag, Manila fiber, and purified chemical wood pulp.

Insulating papers vary from thin tissues to "fish" papers, thick pressboard, and Fullerboard types. Untreated paper has a tendency to absorb moisture, and has little insulating value where

moisture may penetrate, but when impregnated with varnish, oils, or compounds, its high dielectric strength, high insulation resistance, and other valuable insulating properties are maintained.

Paper is used for the insulation of magnet wires and high-voltage cables, and is often used in combination with other insulating materials, such as mica, in making insulating tapes.

Insulating papers for wire are made in three general types, known as Standard, Flexrope, and Super Flexrope. The differences in the three grades lie in the quality of softness, Standard being the most hydrated and therefore the hardest. All three types have a 100 per cent rope content. Other grades contain varying percentages of rope, the remainder of the material used being sulphate wood pulp or cotton fiber. Power-cable insulation is made of 100 per cent Manila fiber, or of 100 per cent sulphate wood pulp, and is not stocked in mixtures of these materials. Some grades are tinted in various colors for identification purposes.

Uses of Insulating Papers.—

(1) Insulation of magnet wire, enameled or bare, both in combination with cotton insulation, or alone.

(2) Insulation for transformer coil wire—dry or liquid-filled types—flat, square, or round.

(3) Lamp-cord insulation, to replace cotton and prevent corrosion of copper by rubber, also to permit easy stripping of insulation.

(4) Insulation of telephone wires in lead-covered cable: (a) as insulation of individual wires, (b) as core wrapping, where paper jackets the cable as a whole rather than individual wires.

(5) Insulation of high-voltage cables.

(6) Insulation of battery cables, automotive wire, and service-entrance cable.

(7) Mica-tape paper.

(8) Capacitor paper.

Motor slot and miscellaneous insulation is available in thin sheets, or in rolls of high-density press paper made of cotton, mixtures of cotton and purified chemical wood pulp, and 100 per cent Manila fiber.

Formex.—Known by its trade name, this modern development in insulation consists of a round magnet wire, the insulation of which is provided by a layer of high-grade paper, bonded or cemented over a very high quality enameled wire. It possesses more than 50 per cent greater dielectric strength than other insulated wires. The over-all size of the insulated conductor is smaller than that of conventional insulation. It therefore enters slots easier, permitting the use of more copper in a given slot area.

Varnishes.—A liquid form of insulation applied to tape, mica, and other materials to give additional electrical protection, and also to give added protection from moisture, oil, and dirt.

In the early days of the electrical industry, shellac and other gum solutions were the only materials available for electrical insulation. Shellac was soon found to be unsatisfactory for many reasons, prominent among which were: (1) brittleness, which caused cracking and flaking off; (2) permeability, which resulted in electrical breakdown in the presence of moisture; and (3) thermoplasticity, which caused the dried film to flow when subjected to heat.

Later, combinations of pitches, asphalts, and gums with drying oils were made available in a wide variety of grades to meet the ever-changing

demands of the electrical industry. Also, it has often been found possible to blend two insulating varnishes having different characteristics to produce a third varnish having characteristics not found in either of the two. Instead of the narrow choice available in the early days of the industry, modern electrical men have a choice of clear and black varnishes, air-drying and baking varnishes, finishing varnishes, oil-proof enamels in various colors, synthetic gum-base varnishes, and many others.

Raw Materials Used.—The chief raw materials used in the manufacture of insulating varnishes may be listed as follows:

Oils: tung oil, linseed oil, soybean oil, oiticica oil, perilla oil, castor oil, and fish oil.

Gums: (natural) rosin, copal, congo, kauri.

Gums: (synthetic) phenol formaldehyde, glyceryl phthalate, maleic, ester, polyvinyl, coumarone, araclor, urea formaldehyde.

Asphalts: gilsonite, manjak, grahamite, Trinidad, and petroleum residues.

Pitches: vegetable, coal tar, animal, and marine.

Driers: lead, cobalt, manganese, zinc, and vanadium are used in conventional varnishes as resinates, linoleates or tungates. The naphthanates of lead, cobalt, manganese, and zinc are used in most synthetic gum-base varnishes.

Thinners.—Benzine (VM & P naphtha, a petroleum derivative), mineral spirits, denatured alcohol, coal tar solvents.

The petroleum solvents are preferred for baking varnishes. Coal tar solvents are sometimes used, but these should not be used when the varnish is to be applied directly over enameled wire. Some of the synthetic gum-base varnishes require a special solvent, in which case it is best to procure this article directly from the varnish manufacturer. If the wrong solvent is used, the solid content of the varnish may be thrown out of solution, the drying retarded, or the finish impaired.

Removing Moisture.—All cotton, silk, and paper covered wires absorb and retain a certain amount of moisture. When units wound with these types of wires are to be treated with insulating varnish, the moisture must be removed and replaced with varnish. If allowed to remain, this moisture would eventually damage the insulation and cause electrical breakdown.

To remove the moisture, it is necessary to preheat the unit to a temperature preferably above the boiling point of water. A temperature of 240° F. is usually regarded as standard. The length of time that units should be preheated depends on the size of the unit and the depth of the winding. A minimum of two hours should be allowed. Any air remaining inside the windings will be expanded considerably, as it will be at a temperature of 240° F. On immersion in the varnish, this air will cool and contract, thus drawing additional varnish into the windings. The heat imparted by preheating also tends to drive off solvents from inside the windings, and helps to insure an even bake throughout.

Uses for Insulating Varnishes.—There are many uses for the various types of insulating varnishes that are on the market.

Baking Varnishes.—These varnishes should be used, when possible, for new coils and windings, as they give much greater flexibility. Because they dry more thoroughly, there is less danger of solvents being trapped. Some air-drying var-

nishes will "skin" in the can, so on voids they will "surface seal" and trap solvents unless great care is used. There are times when the dimensions of the unit to be varnished are such that adequate oven space is not available for baking.

In this case a carefully selected air-drying varnish may be used. This type of varnish must be carefully applied. If a heavy coat is required, several thin coats are better than one thick coat, and each coat should be allowed to dry thoroughly before applying the next. A baking varnish is also preferable in repair work, although an air-drying varnish may be used; but it must be remembered that the life, flexibility, and resistance to oils, alkalies, and acids, will not equal that of a baking varnish.

Air-Drying Varnishes.—Widely used as finishing varnishes, for extra protection, are air-drying varnishes. An air-drying varnish such as Synthite No. 924, applied over an oilproof varnish, affords a greater protection against alkalies. Air-drying varnishes are also used a great deal in emergency rush work.

Finishing or Spirit Varnishes.—These varnishes are used chiefly for preventive maintenance work. A periodic coat of spirit varnish will fill cracks and seal defects that occur in the original insulation. A finishing varnish is often applied over a nonoilproof air-drying varnish, thus giving it an oilproof surface.

Oilproof Enamels.—This enamel is generally used on commutator end bars, V-rings, and string bands to prevent any creepage of oil from the bearings to the windings. There are two types in general use, the quick-drying alcohol solvent grades, and the slow-drying flexible grades. The latter has greater flexibility, and is used on coils where expansion and contraction prohibit the use of any varnish giving a brittle surface.

Synthetic Gum-Base Varnishes.—These varnishes serve many purposes. Some produce a hard finish which holds the wires in one solid mass, thus preventing any movement of the wires in the slots of a high-speed armature, and eliminating internal short circuits, or throwout. A varnish of this type may be used in deep coils while they are being wound; a coat is applied with a brush to each layer, and when it is baked, no wet varnish is trapped in the coil, as occurs in the use of conventional baking varnishes.

Other grades are so formulated that a second coat may be applied after the first coat has been baked for a short period; the oil is dipped, drained, and baked for one hour, then a second coat is applied, and finally a full bake is given. This method saves time and money. Many of these varnishes also afford exceptionally good protection against chemical corrosion, and some provide very high dielectric strength.

Insulating Compounds.—This type of material falls into three main classifications:

Impregnating Compounds.—While chiefly used to fill voids in certain types of coils, particularly when the voids are too large to be filled successfully with varnish, these compounds are also applicable where an extremely heavy coating is required over the winding of a coil. Although these compounds can be applied by dipping, they are often applied by the vacuum-and-pressure-impregnating process.

Filling Compounds.—One type of these compounds is used to fill in between coils and containers, for example in certain types of transformers, such as radio and neon sign transformers.

Other types are used for cable splices, potheads, and bifurcating boxes. Still other types are designed for filling countersunk screwheads, and for other such purposes, in switchboards and panels.

Stator Compounds.—These compounds differ from the two foregoing classifications in that they are supplied in a semifluid state, and are either air dried or baked. They are applied to the exposed ends of stator coils with a trowel, or putty knife, to provide a solid, impervious seal. If the implement with which they are applied is repeatedly dipped in benzine, a smooth finish will result. Certain types of stator compounds are furnished at a consistency that allows them to be applied with a brush.

Plastics.—Since the invention of Bakelite in 1909, plastics have played an important part in electrical insulation. Plastics are used in practically all electrical devices, and have given the designer and user of such equipment many advantages over older insulating materials. Plastics provide not only insulation, but also a means for supporting or mounting electrical devices, in which capacity they take the place of wood, slate, porcelain, marble, and other materials formerly used. There are many plastics available having desirable characteristics for insulation. They are as well established as solid insulation, and give great promise for the insulation and protection of wires and cables. The more important plastics are listed in Table 2.

portant part of all electrical equipment. In the group are many different grades and types, but they are all related because they employ the same or similar ingredients combined in a different manner.

Each of the materials is made of a filler (or base) and a binder. The fillers used are cotton, glass fibers, asbestos fabrics, paper, and mica flakes. The binders are numerous types of synthetic resins, varnishes, shellacs, and gelatinizing chemical compounds, such as zinc chloride. There are many different types within these classes of fillers and binders which permit almost unlimited selection for controlling the properties of laminated products.

Laminated insulating materials are produced in sheet, rod, and tube form. An unlimited variety of insulating parts for electrical equipment can be fabricated from these basic forms by machining, forming, and punching methods. The outstanding characteristics which account for the widespread use of this class of insulating materials are: dielectric strength, power factor, water resistance, mechanical strength, light weight, and toughness. Other desirable properties such as resistance to chemicals, vibration-damping capacity, and the low coefficient of friction, are responsible for many other uses of these materials, in which electrical insulation is not a primary requirement.

Vulcanized fiber is made by laminating sheets of rag paper treated with zinc-chloride solution

TABLE 2—SYNTHETIC MATERIALS WITH PROMISING CHARACTERISTICS AS ALTERNATIVES TO RUBBER FOR WIRES AND CABLES FOR INSULATION

Material	Chemical Type	Remarks
Buna S	Butadiene Polymer	Vulcanizable. Rubber-like. Copolymer with styrene. Extrudable.
Butyl Rubber	Hydrocarbon Polymer	Vulcanizable. Extrudable.
Ethyl Cellulose	Cellulose Derivative	Thermoplastic. Extrudable.
Hycar EP	Butadiene Polymer	Vulcanizable. Rubber-like. Copolymer. Extrudable or calendered strips.
Polythene	Ethylene Polymer	Thermoplastic. Extrudable.
Polystyrene-Rubber	Styrene Polymer with Rubber	Mix with rubber and vulcanize. Extrudable.
Saran	Vinylidene Chloride Polymer	Thermoplastic. Applicable as threads or tapes.
Styron	Styrene Polymer	Thermoplastic. Not extrudable. Threads or tapes.
Tenite II	Cellulose Derivative	Thermoplastic. Extrudable. Cellulose-acetate-butyrate.
Vistanex	Isobutylene Polymer	Not vulcanizable. Rubber-like. Mixed with resins or rubber. Extrudable.
<i>For Jacket or Covering</i>		
Chemigum	Butadiene Polymer	Vulcanizable. Rubber-like. Copolymer. Extrudable or calendered strips.
Hycar OR	Butadiene Polymer	Vulcanizable. Rubber-like. Copolymer. Extrudable or calendered strips.
Perbunan	Butadiene Polymer	Vulcanizable. Rubber-like. Copolymer with acrylonitrile. Extrudable or calendered strips.
Thiokol	Organic Polysulfides	Both thermoplastic and vulcanizable types. Extrudable.
<i>For Insulation or Jacket</i>		
Koroseal	Plasticized Vinyl Chloride Polymer	Thermoplastic. Extrudable.
Neoprene	Chloroprene Polymer	Vulcanizable. Rubber-like. Extrudable or calendered strips. Several types.
Vinylite	Plasticized Vinyl Chloride Polymer	Thermoplastic. Extrudable. Copolymer with vinylacetate.

A very important plastic insulating material known as the *silicon resins* offer great possibilities for electrical insulation. They are well adapted to this use, and superior to all other insulating materials where thermal aging or excessive moisture are encountered. Silicones are used primarily as a varnish or binder. The use of silicon resins will make it possible to operate electrical machinery, such as motors and generators, at higher temperatures than ever before, and will accordingly reduce their size for a given output.

Laminated Insulating Materials.—This large group of materials forms an essential and im-

portant part of all electrical equipment. In the group are many different grades and types, but they are all related because they employ the same or similar ingredients combined in a different manner.

The dielectric strength of fiber may be reduced as much as 75 per cent after prolonged exposure to humid atmosphere. Under no cir-

cumstances should it be used as an insulating material where even occasional immersion in water is likely to occur.

Fish paper insulation is an exceedingly tough insulating paper developed primarily as an insulation for armature slots and field coils. Extra strong fibers are used, and the chemical treatment, which is somewhat different from that used in the manufacture of vulcanized fiber, insures those qualities which are most essential in an insulating paper. Such insulation is made in sheet and continuous rolls, or in ribbon rolls for automatic machines. It is furnished in a natural dark gray color only. In manufacturing electrical equipment, fish paper insulation is used in armature wedges, slot insulation, attachment plugs, brush backs, brush-holder bushings, bushings, casings for enclosed fuses, commutator rings, insulation for armature and field coils, ignition cable tubes, panel boards, push buttons, switch bars, arc chutes, interpole barriers, rail and trolley insulation, and grommets.

Fiber may also be treated during the process of manufacture with special waterproofing resin. Fiber thus treated possesses characteristics which qualify it for many uses in the electrical industry. It is hard, and will resist abrasion; it is dense, tough, and strong; it has high dielectric strength; it has good arc resistance, but not so much as has untreated fiber; it is easily machined; and it resists moisture better than does untreated fiber.

Laminated insulation in tubular form, which is widely used, is made by impregnating special kraft paper with resin and shellac mixtures, and by subsequently heating it under pressure. Such tubes are more resistant to arcing than most synthetic resinous laminated materials, and they possess excellent dielectric properties. These tubes are used for bus insulation, cable joints, wall bushings, supports, transformer tank linings, motor and generator brush holders, collector rings, coil supports, and for other such purposes.

Insulation for Transformers and Circuit Breakers.—Insulation used for transformers and circuit breakers is usually made up in sheets of layer insulation, for small spaces, and for encircling the entire core in transformers. Most insulation of this sort consists of new cotton cuttings and purified chemical wood pulp, and is made up in the following three grades: (1) 100 per cent cotton rag; (2) 75 per cent cotton rag, 25 per cent purified chemical wood pulp; and (3) 50 per cent cotton rag, 50 per cent purified chemical wood pulp.

Commutator Insulation.—Either white or amber mica is used for commutator insulation. However, if white mica is used for commutator segments, it is necessary to undercut the segment, as the copper bars wear faster than the mica, thus causing a rough surface and a pitting of the bars. To offset this disadvantage, white mica plate is usually less expensive than amber. Amber mica, however, is sufficiently soft to afford even wear with the copper bars, and for this reason undercutting is not usually necessary.

Consult Moses, G. L., *Electrical Insulation* (New York 1951).

E. S. LINCOLN,
Consulting Engineer.

INSULIN, ɪn'sū-līn, one of the class of substances called hormones, which have the peculiar function of exciting action in some other organ of the body, at a greater or less distance. The duty

of the hormone insulin is to regulate the metamorphosis of sugar (glucose) into fat. In the absence or insufficiency of insulin, the excess of sugar is found to be forced into the urine, and also is deposited in the muscular tissue of the heart, and the diseased condition known as diabetes results. Insulin is a product of those parts of the pancreas known as the islets of Langerhans, from their discoverer, and was isolated first by Dr. F. G. Banting, of the University of Toronto, and thus made available as a remedial agent in the treatment of diabetic conditions. As the insulin must become a part of the blood stream to accomplish its function, the present treatment is by way of hypodermic injection, administered by a physician. Efforts are being made to devise some insulin-carrying substance which can make its way into the blood stream when taken by the mouth, as are other medicines. Chemically, insulin is a proteose substance, with the formula, $C_{90}H_{150}O_{24}N_{22}S_2$. See also DIABETES MELLITUS; MEDICINE, HISTORY OF —11. *The 20th Century* (Endocrinology).

Consult Haugaard, N., and Marsh, J. B., *Action of Insulin* (Springfield, Ill., 1953).

INSURANCE, ɪn-shōōr'āns, the act whereby for a consideration (the *premium*), one party (the *insurer*) binds himself in a contract (the *policy*) to indemnify or guarantee another (the *insured*) against loss through the happening of a specified contingency (the *risk*). The device of insurance is one of the important safeguards developed for eliminating or reducing loss to the individual arising from certain kinds of risk. Moreover, in providing protection against potential loss, it performs a social function even if no loss occurs, this function serving notably in circumstances where credit is used. Reduction or prevention of loss also is an objective to which the activities of the insurance business increasingly are directed.

Risk may be defined as the chance of loss (though the word is used commonly also to refer to the subject of the risk); hazard, as the cause or source of the loss. Risks are estimated according to the expectation of loss and may be classified with respect to their nature into: (1) *physical risks*, depending on age, health, condition, location, structure, occupancy, and exposure; and (2) *moral risks*, arising from such mental conditions as motivate dishonesty, negligence, and insanity. Hazards may be: (1) common to all in a community, as price changes, wars, and windstorms; or (2) restricted to individuals, as occurrences causing loss or injury to one's self or property, or causing loss or injury to another or his property.

Except in self-insurance, the basis of insurance is the pooling of risks by the transfer of individual risks to a group. The insuring group, or carrier, may be an association, a corporation, or a government. In order to continue its function, it must collect funds sufficient to pay losses and expenses. To do this successfully the aggregate of risks so transferred must be large in numbers and widely spread. The method of weighing the risk and fixing the premium is based upon the *law of large numbers* as used to apply the *theory of probabilities*. This law is derived from the observation that the larger the number of instances taken, the closer the result approximates the theoretical probability. In certain lines of insurance the nature of the risks

permits the calculation of elaborate and precise tables.

With respect to the kind of subject matter insured, insurance may be divided broadly into: (1) *personal insurance*, including life, disability, and social insurance; and (2) *property insurance*, including fire, marine, casualty, liability, and fidelity insurance, and suretyship. In point of priority, the practice of marine insurance long preceded insurance against fire and upon lives. In our modern conception of the term it existed among Italian traders before the year 1400, and was introduced by them to London. There the organization of underwriters at Lloyd's began to operate shortly after 1688. In America, marine insurance has been available since the early 1700's. Though life insurance policies were issued in England in the latter part of the 16th century, such insurance did not become common until after 1700. The first corporation for insuring lives in America was the Presbyterian Ministers' Fund, chartered in 1759, but the real growth of life insurance in the United States did not come until after 1850. Fire insurance dates from the great fire of London of 1666, and in the following century a number of companies were organized in America to write this type of coverage. The various lines of casualty insurance are of more recent origin, the youngest important one being aviation insurance. In this, Lloyd's wrote the first policy in London in 1912, and their underwriting agency in America was the first there, 10 years later.

In the United States in 1956 there were approximately 1,144 legal reserve life insurance companies, fraternal orders, and assessment associations; in addition 288 banks were writing savings bank life insurance in the states of Massachusetts, New York, and Connecticut, where this type of life insurance is permitted by law. Operating in the fire and allied lines and marine fields there were approximately 400 stock companies and 2,600 large and small mutual companies. Of the fire and allied lines stock companies, 227 were National Board of Fire Underwriters members. In the same field there were 64 reciprocal and interinsurance exchanges and 14 American Lloyds organizations. There were approximately 223 stock and 140 mutual companies writing casualty and surety insurance, with an estimated 30 reciprocals, interinsurance exchanges, and American Lloyds. In addition there were approximately 90 assessment accident and health insurance associations. A large number of Blue Cross and Blue Shield medical care and hospital service plans have been organized since World War II.

In 1955, on the recommendation of the National Association of Insurance Commissioners, enabling legislation was enacted in all states of the United States to permit fire and casualty insurance companies to engage in full multiple-line underwriting. Multiple-line underwriting means that a single fire or casualty insurance carrier may underwrite several classes of insurance, except life. The result has been the merger of many fire and casualty companies, or the purchase of one type of company by the other to operate as a separate entity.

Apart from private enterprises, various governments and governmental agencies in the United States engage in a fairly wide range of insurance, quasi-insurance, and pension plans. State and local activities include workmen's compensation

funds, public property insurance funds, a small state life insurance fund (Wisconsin), hail insurance in three states (North Dakota, Montana, and Colorado), and a large number of pension systems for teachers, firemen, and other public employees. The operations of the federal government in this general field are broad. There are pension funds for war veterans and federal employees, an unemployment insurance plan, a system for retirement and unemployment benefits for railroad employees, indemnification plans for bank and building loan accounts, and crop insurance. The Social Security Act was passed in 1935, and under its amendment of 1939 the system of old-age and survivors insurance was inaugurated. In 1956 the law was further amended to include provisions for optional retirement age (62) for working women, an earlier option for wives of retired workers, and earlier benefits for widows. The amendments also provided for certain disability benefits to covered persons.

The government's first plan of life insurance for members of the armed forces, the United States Life Insurance, was instituted during World War I, and in 1940 the National Service Life Insurance was provided for those in World War II. In the latter war, the government also sponsored the War Damage Corporation in writing policies of protection against enemy attack.

In 1954 a federal employee group life insurance plan was created by a special act of Congress. It was the largest single group plan ever written, covering two million federal government employees in the United States for a total of \$10.1 billion in 1956. This vast program was underwritten by the life insurance companies.

Supervision and regulation of insurance companies were administered exclusively by the several states until 1944, when the United States Supreme Court held that the business of insurance is commerce and that, when its activities cross state boundaries, it is interstate commerce and thus subject to regulation by Congress under the commerce clause of the federal Constitution.

As a business institution, insurance performs important services in American economic and social life. Its scope may be appreciated from the following data. On Dec. 31, 1946, the total assets held for the benefit of policyholders by all legal reserve life insurance companies in the United States were estimated at \$96.25 billion; those of the stock and mutual fire and marine companies, over \$4 billion; and those of the stock and mutual casualty companies, over \$3 billion. On the same date, the life insurance companies carried insurance in force of over \$412.63 billion. The coverages written by the fire, marine, casualty, and surety companies, by their very nature do not readily yield estimates of the total liabilities assumed.

Investments comprising the assets of American insurance companies are a cross section of the economic life of the nation. They are widely diversified not only as to kind, maturity, industry, and company, but geographically as well, within the United States and Canada. This diversification has not only meant greater safety for policyholders, but has also served the useful purpose of bringing to many sections of the country a more adequate supply of capital than would be available locally. Of special importance is the increasing interest developed in housing

projects; though the tendency was initiated by the larger companies, the smaller ones have also entered the field. See also separate articles on the various types of insurance mentioned, such as FIRE INSURANCE; HEALTH INSURANCE; LIFE INSURANCE; and others.

**DISTRIBUTION OF ASSETS, ALL UNITED STATES
LEGAL RESERVE LIFE INSURANCE COMPANIES**
Estimated Dec. 31, 1956
(millions of dollars)

	Amount outstanding	Per cent of total
Bonds		
United States government	\$ 7,600	7.9
*State, county, and municipal	2,250	2.3
*Canadian government	1,050	1.1
*Other foreign governments	50	.1
Total government	10,950	11.4
Railroad	3,900	4.0
Public utility	14,500	15.1
Industrial and miscellaneous	19,900	20.7
	49,250	51.2
Stocks		
Railroad	150	.2
Public utility	1,400	1.4
Other	2,100	2.2
	3,650	3.8
Mortgages		
Farm	2,500	2.6
Other	30,600	31.8
	33,100	34.4
Real Estate	2,850	3.0
Policy loans and premium notes	3,500	3.6
Cash	1,200	1.2
Other assets	2,700	2.8
Total assets	96,250	100.0

*Includes turnpike revenue bonds. †Includes all political subdivisions. Source: Institute of Life Insurance and Life Insurance Association of America.

INSURANCE TERMS

Words of precise meaning used to define insurance contracts, or used in connection with such contracts follow:

Abandonment.—In ocean marine insurance, the exercise by the insured of his right, in the event of constructive total loss, of relinquishing to the insurer the salvage in order to establish a claim for total loss.

Abordage.—In ocean marine insurance, the obligation of the insurer of a ship damaged by another ship through collision on the open sea to indemnify the insured for the loss, with right of recovery at civil law against the party causing the damage.

Acceptance.—In general, the validating act to insurance contract by the insurer in agreeing to accept for a specified premium a risk offered for insurance. In ocean marine insurance the act of the insurer that perfects the rights of the insured in the recovery of his loss when he has offered abandonment.

Accident Insurance.—Indemnifies for bodily injury or death caused by accident, including loss of time from occupation, and hospital, nurse, surgical and medical expenses. See also separate article **LIABILITY INSURANCE**.

Accounts Receivable Insurance.—Indemnifies for loss through inability to collect accounts because of damage to, or destruction of, records.

Actuary.—In insurance, the official in an insurance company whose function is to make the mathematical calculations necessary to maintain the business on a sound financial basis; these include the valuation of contingent liabilities, the computation of risks, the construction of premiums, and the determination of various items as reserves, loss ratios, dividends, and nonforfeiture values.

Agreement.—In insurance, a contract written or oral between the insurer and the insured made before the issuance of the policy. It embodies an understanding on essential provisions.

Agricultural Insurance.—See article **CROP INSURANCE**.

Agricultural Machinery and Equipment Insurance.—Under an inland marine insurance policy it provides coverage on mobile agricultural machinery and equipment (not on sale or consignment, or in course of manufacture), which has come into the custody or control of parties who intend to use

such property for the purpose for which it was manufactured or created.

Aircraft Hull Insurance.—Indemnifies for loss or damage to aircraft or parts thereof arising from all risks or specified perils.

Aircraft Liability Insurance.—Covers legal liability of owner or operator of aircraft for bodily injury, death, or property damage arising from ownership, maintenance, or use of aircraft covered by the policy.

Aircraft or Vehicle Property Damage Insurance.—Indemnifies for damage to property resulting from collision with, and caused by, aircraft or objects falling therefrom, or other vehicle, not owned by insured.

Aircraft Personal Accident Insurance.—Indemnifies passengers or pilots for bodily injury or death caused by aircraft accident.

Airmen's Liability Coverage.—Special form of aircraft liability insurance, providing coverage for airmen's.

Airport Liability Coverage.—Special form of aircraft liability insurance, providing coverage for airport owners and operators.

All Risks Coverage.—Insures against all risks or loss or damage directly arising from any external cause; certain forms specify exclusions.

American Experience Table of Mortality.—Shows number of people dying each year by age groups used by life insurance companies in fixing premium rates.

Annuity Policy.—Provides income to one or more persons for life or for a specified period. Different forms are available to meet particular needs; with the exception of the *annuity certain*, which continues for a specified time regardless of any contingency, annuity payments are contingent on the happening of some agreed event, as the first death of a number of beneficiaries in a *joint life annuity*, or the last death of a number of beneficiaries in a *last survival annuity*. Payments are made at fixed intervals.

Assessment.—In ocean marine insurance, the contribution apportioned among the various interests in general average. In mutual insurance companies, a call upon premium notes given by members as a substitute for the investment of paid-up stock.

Assessment Insurance.—A form of life insurance written by certain fraternal societies or associations wherein the premium payments are not fixed in the policies but determined by the insuring organizations as the needs to meet claims require.

Assigned Accounts Bond.—Guarantees that borrower will apply to reduction of loan collections from accounts receivable pledged as collateral.

Automatic Coverage.—Operates to include change in subject matter insured or its location without notice to insuring company.

Automobile Insurance—Damage to One's Own Car.—Indemnifies owner for loss or damage to his automobile or its contents. See also separate article **LIABILITY INSURANCE**.

Automobile Liability Insurance.—Covers legal liability for bodily injury, death or property damage arising from ownership, use, or maintenance of any automobile covered by the policy. Medical payments coverage may be included at the option of the insured. It provides for payment of all reasonable expenses incurred within one year from date of accident for necessary medical, surgical, dental, ambulance, hospital, professional nursing and funeral services to or for each person injured while in, upon, entering or alighting from the automobile covered by the policy, and to or for each insured injured through being struck by an automobile. See also separate article **LIABILITY INSURANCE**.

Automobile Nonownership Liability Coverage.—Extension of coverage of automobile liability insurance to include legal liability of insured arising from use by his employees in his business of automobiles not owned by him. See also separate article **LIABILITY INSURANCE**.

Average Clause.—See term *Coinurance or Average Clause*.

Aviation Insurance.—A class of insurance comprising aircraft hull, aircraft liability, and aircraft personal accident insurance.

Bail Bond.—Assures appearance of arrested person or payment by surety of penalty.

Bailee's Customers' Floater.—Provides coverage for laundries, dyers, cleaners, tailors against loss or damage to customers' property during processing on premises, or in transit.

Bailee's Liability Insurance.—Covers legal liability of custodian of goods of others for loss or damage by named perils, excluding those of improper processing.

Bankers' Blanket Bond.—Provides coverage for financial institutions against loss arising from dishonesty of employees, burglary, inside or outside robbery, and also from forgery if this additional coverage is purchased.

Barratry.—In ocean marine insurance the willful commission of any unlawful or fraudulent act or breach of duty in the management of a ship or its cargo to

- the injury of the owner and without his consent.
- Bid Bond.**—Guarantees that bidder on contract will undertake contract if it is awarded to him.
- Binder.**—Form protecting insured till policy is issued, and subject to policy's conditions.
- Blanket Policy or Form.**—Covers several properties or risks in one instrument.
- Blanket Position Bond.**—A fidelity bond covering all employees insured, each separately for uniform amount, new or substituted employees being automatically covered.
- Boiler and Machinery Insurance.**—A class of insurance comprising a number of liability and direct damage coverages against loss, damage, bodily injury, or death caused by boiler or machinery accidents.
- Brokers' Blanket Bond.**—Provides coverage for securities brokers similar to that of bankers' blanket bond.
- Burglary Insurance.**—See separate article **BURGLARY INSURANCE**.
- Business Interruption Insurance.**—Indemnifies for operating expenses continuing, and profits not earned, during period when business is interrupted by risk insured against.
- Capital Sum.**—Amount or portion thereof payable in accident insurance policy upon specified disability caused by accident.
- Cargo Insurance.**—Covers merchandise during ocean transportation together with shore and inland risks incidental thereto.
- Cash Surrender Value.**—Amount receivable by life insurance policyholder when he cancels his policy or permits it to lapse; it is an optional nonforfeiture value.
- Casualty.**—A term frequently used in insurance as a synonym for accident.
- Casualty Insurance.**—A general class of insurance embracing those forms that indemnify insured for certain kinds of losses caused by accident to his own person or property, and those that cover his legal liability to others for bodily injury, death, or property damage.
- Coinsurance.**—Sometimes known as the **REDUCED RATE CONTRIBUTION or AVERAGE CLAUSE**, it is applicable to property damage insurance of various kinds but is most prominent in fire insurance. Its purpose is to distribute equally the cost of insurance over the insuring public in proportion to individual valuations which are also appraised for relative hazards. Provides that the insurer shall be liable in the event of loss for not more than that proportion of the loss which the amount of insurance under the policy bears to the specified percentage of the actual cash value of the property insured. The percentage of coinsurance may vary but 80 per cent predominates. The coinsurance clause in the contract that the insured will maintain insurance to the extent of 80 per cent of the value of the property being insured or become a coinsurer for the difference. Thus a \$10,000 building subject to the 80 per cent coinsurance clause would require a minimum of \$8,000 insurance. In the event that only \$4,000 insurance is carried, a \$2,000 loss would receive a \$1,000 contribution from the insurance company leaving the other \$1,000 to be contributed by the insured.
- Collapse Insurance.**—Collapse insurance is now being written in many dwelling forms and under some new all-risk type forms available for commercial property. The Additional Extended Coverage Endorsement, The Dwelling Building(s) Special Form are among those containing collapse coverage for dwelling risks.
- Collision Insurance.**—In automobile insurance, indemnifies owner for damage to his automobile caused by collision with stationary or moving object. Collision coverage is provided also in other types of insurance, as aircraft or vehicle damage, aircraft hull, ocean marine, and elevator insurance.
- Comprehensive Automobile Liability Policy.**—Covers legal liability of insured arising from any hazard involved in maintenance, operation, or use of any automobile regardless of ownership.
- Comprehensive Dishonesty, Disappearance, and Destruction Policy.**—Combines coverages of primary commercial blanket bond, the two forms of money and securities policies, securities insurance policy (for lessees of safe-deposit boxes), and depositors' forgery bond; usually all or any combination of these coverages may be selected.
- Comprehensive General-Automobile Liability Policy.**—Combines coverages of comprehensive automobile liability and comprehensive public liability policies.
- Comprehensive Liability Insurance.**—A class of insurance embracing those forms that on a broad basis cover legal liability of insured for any hazard not excluded.
- Comprehensive Personal Liability Policy.**—Broad form of coverage for individual's legal liability for bodily injury or death; includes sports and residence coverages and embraces acts of insured's wife, minor children, and pets.
- Comprehensive Public Liability Policy.**—Covers legal liability of insured for bodily injury or death sustained by persons not in his employ, except liability arising from maintenance, operation or use of automobiles.
- Compulsory Insurance.**—Refers to those forms of insurance that are required by statute in certain jurisdictions. Common examples are automobile liability, workmen's compensation, and social old age and unemployment insurance.
- Consequential Damage Coverage.**—By endorsement on direct damage policy, indemnifies for indirect loss arising from accident to an insured object on premises, as from fire, explosion, or breakdown.
- Constructive Total Loss.**—May be established when cost of recovering and repairing damaged property would be commercially unprofitable.
- Contract Bond.**—Guarantees that party to a contract, commonly for construction or engineering work, will faithfully perform its terms.
- Contractors' Public Liability Policy.**—Covers legal liability of insured for bodily injury or death arising from his contract operations, including the existence of tools and equipment left or abandoned at place of work.
- Contractual Liability Policy.**—Protects insured against liability of others, which he has assumed, for bodily injury or death.
- Court or Judicial Bond.**—Assures to litigant in court pursuit of remedy, or protection to his adversary; there are many types and their forms are prescribed by law.
- Coverage.**—Denotes the protection promised against the risks specified in an insurance contract.
- Credit Insurance.**—Guarantees payment to insured of bad debt losses in excess of specified amount, with special provisions for coinsurance on certain classes of risks. See also separate article **GUARANTY INSURANCE**.
- Crop Insurance.**—See separate article **CROP INSURANCE**.
- Custodian's Bond.**—Guarantees that custodian will retain possession of property pledged as collateral by borrower till loan is repaid, with partial withdrawals authorized by lender.
- Customs Bond.**—Guarantees payment of duty and taxes on entry into United States of property from foreign source.
- Deductible Clause.**—As applied to insurance, specifies amount in excess of which the insured may recover in claim for loss.
- Deferred Insurance.**—A form in which the liability of the insurer does not begin until a specified future date.
- Depositors' and Commercial Forgery Bond.**—Provides coverage of depositors' forgery bond and also coverage against 75 per cent of insured's pecuniary loss through forgery or alteration of negotiable instruments received for goods delivered or services rendered.
- Depositors' Forgery Bond.**—See term *Forgery Bond*.
- Depreciation Insurance.**—Provides indemnity for loss measured by the difference between value of building less depreciation and cost of replacing a building of like character.
- Deviation.**—In ocean marine insurance, the voluntary departure of a vessel, without necessity or reasonable cause, from the usual course of the voyage for which she was insured; such a departure is held to be a breach of an implied warranty by the insured and terminates the liability of the insurer. On the same reasoning any unusual or unnecessary delay releases the insurer from all risks.
- Disability Insurance.**—A general class of insurance embracing those forms, as accident, and health insurance, that indemnify for loss through disability as distinguished from death.
- Discovery Bond.**—A fidelity bond covering losses discovered during life of bond though occurring previously.
- Dog Liability Coverage.**—See terms *Residence, Farm Liability Insurance; Comprehensive Personal Liability Policy*.
- Double Indemnity Provision.**—In life, accident, and health insurance, provides double the amount payable, if death or specified disability is caused through specified accidents.
- Double Insurance.**—Exists when two or more policies cover the same interest of the same insured against the same risks in proportions exceeding the sum necessary to provide complete protection. The insured may sue upon all the policies although he may obtain but one satisfaction.
- Elective Indemnity Provision.**—In an accident insurance policy, this provision grants option to insured to choose with respect to specified disabilities between receiving scheduled amounts at once or in weekly payments.
- Elevator Insurance.**—In various forms, provides coverage for legal liability of insured for bodily injury, death, or property damage arising from existence or

- use of elevator or equipment, and provides indemnity to him for damage to his own property through collision of elevator or object carried thereon with another object.
- Employers' Liability Insurance.**—Covers legal liability of employer for bodily injury or death to employees; restricted to employees not under workmen's compensation laws.
- Endowment Insurance.**—Provides for payment of policy amount at end of specified period, as 10 or 20 years, or at age 55, 60, or 65.
- Equipment Dealers Insurance.**—Designed for and issued to dealers in mobile agricultural and construction equipment, the property of the assured and the property of others in the custody or control of the assured, for sale, display, demonstration, storage, service, repair or for the purpose of performing work thereon.
- Errors and Omissions Insurance.**—Provides coverage for financial institutions with loans on mortgaged property as collateral, against loss arising from inadequate insurance on such property resulting through error.
- Excess Commercial Blanket Form.**—Provides fidelity coverage in excess of primary coverage on schedule or blanket forms.
- Excess Indemnity Endorsement.**—On blanket position bond, provides fidelity coverage against loss caused by employees in any positions selected in excess of primary coverage.
- Expense Loading.**—Portion of premium calculated to meet insured's share of the operating expenses of the insuring company.
- Extended Coverage Endorsement.**—Extends fire insurance coverage to include windstorm, hail, explosion, riot, aircraft, motor vehicle, and smoke damage. The purpose is to market all of these coverages under a single policy. Additional Extended Coverage Endorsement is a form attachable to a fire insurance policy, provided the Extended Coverage Endorsement is also attached. Available only for dwellings, the form provides coverage for the perils of water damage, explosion of steam boiler, vandalism and malicious mischief, vehicle damage by owned vehicles, fall of trees, objects falling from weight of snow, freezing of plumbing, collapse, landslide, breakage of glass. (Coverage of landslide has been deleted in some jurisdictions.)
- Extended Term Insurance.**—Provides coverage to life insurance policyholder in policy amount for such period as would be purchased by the cash surrender amount used as single premium payment; it is an optional nonforfeiture value and usually operates automatically if holder does not select a different nonforfeiture value.
- Extra Expense Insurance.**—Protects any type of organizations which cannot afford to have its business interrupted by fire but must incur whatever additional expense is necessary to maintain operations constantly. It should not be confused with Business Interruption Insurance.
- Fidelity Bond.**—Indemnifies employer for loss of property, owned by him or in his custody, through dishonesty of his employees.
- Fiduciary or Probate Bond.**—Guarantees faithful performance of court orders, and of official duties, as collection, safekeeping, distribution, and accounting, by official, as executor, administrator, trustee, receiver, appointed by court to administer estate funds.
- Fine Arts Floater.**—Indemnifies for loss or damage to scheduled objects of art, in named or any location, arising from all risks with exceptions, and from named perils.
- Fire Insurance.**—Indemnifies for stated term for loss or damage to specified property by fire. See also separate article **FIRE INSURANCE**.
- First Class Mail Insurance.**—Designed to provide all risks coverage for banks, bankers, trust companies, insurance companies, security brokers, investment firms, investment corporations, stock clearing corporations and corporations when acting as security transfer agents or registrars for their own security issues. Shipments of bonds, coupons, stock certificates and other securities by first class mail and first class air mail are covered between places in the continental United States, excluding Alaska.
- Floater Policy, or Floater.**—Covers mobile property not easily insured by specific forms because it changes value or location; in ocean marine insurance, covers cargo on any ships of approved lines.
- Forfeiture Bond.**—Type of bond that grants to obligee right to demand payment of full penalty for any infraction of bond conditions.
- Forgery Bond.**—Indemnifies for loss through forgery or alteration of negotiable instruments. There are many forms, as for depositors, financial institutions, and securities houses.
- Fraternal Insurance.**—A class of life insurance providing mutual protection, on the cooperative plan, to their members by noncapital stock societies. Such societies aim also to engender fellowship and benevolent helpfulness through activities of a lodge system.
- Freights Insurance.**—Covers freight as cargo, if at risk of cargo owners; covers voyage freight or charter hire for account of vessel owner.
- Fur Floater.**—Indemnifies individuals for loss or damage to furs and fur garments in any location arising from all risks with specified exclusions.
- Furrier's Customers' Floater.**—Provides coverage for furrier against loss or damage to fur or fur-trimmed garments left for storage, alteration or repair.
- Garage Liability Insurance.**—Covers legal liability of garage owner arising from ownership, maintenance, or use of any automobile in insured's premises, and such liability arising from ownership, maintenance, occupation, or use of the insured premises.
- Garment Contractor's Floater.**—Provides coverage for manufacturer of clothing against named perils on premises of his contractors and their subcontractors, and against transit risks.
- General Average.**—In ocean marine insurance, a loss caused or extraordinary expense incurred by voluntary and successful act to avert common peril, requiring contribution by all insureds to indemnify interests affected by such loss or extraordinary expense.
- General Average Bond.**—Guarantees that owner of goods subject to general average will pay his proportionate contribution when ascertained; it is given to obtain immediate release of such goods.
- Glass Insurance.**—Indemnifies for loss through breakage from any cause except fire, and for damage through acids or chemicals, to various kinds of glass, including lettering and frames.
- Group Annuity Policy.**—Provides income to employees for life after retirement age.
- Group Insurance.**—See separate article **GROUP INSURANCE**.
- Hangar Keepers' Liability Coverage.**—Special form of aircraft liability insurance, providing coverage for owners or operators of aircraft hangars.
- Health Insurance.**—Indemnifies for loss of time from occupation through sickness, and for hospital, nurse, and surgical expenses, and in one form also for medical expense; written only in combination with accident insurance. See also separate article **HEALTH INSURANCE**.
- Hospitalization Insurance.**—Indemnifies for hospital and related charges incurred through accident or disease.
- Hull Insurance.**—See terms *Vessels, Hull Insurance; Aircraft Hull Insurance*.
- Identification Indemnity Provision.**—In accident insurance policy, undertakes to pay expense of notifying insured's relatives and putting him in their care, with limit usually of \$100, if by reason of injury he is unable to communicate with them.
- Indemnity Bond to Sheriff.**—Type of court bond protecting sheriff against loss for wrongful attachment or sale of property.
- Industrial Life Insurance.**—Provides coverage similar to that of ordinary life insurance but not in so many forms and usually with earlier age of maturity; the amounts of insurance, determined by the age of the insured at the time of issuance of policy and by the amount of his premiums, are small, averaging less than \$300, and the premiums are payable weekly or monthly.
- Inland Marine Insurance.**—A class of insurance embracing those forms that indemnify for loss or damage through sundry perils to various kinds of mobile property in transit.
- Installment Floater.**—Provides coverage for vendor, or vendor and vendee, against loss through transportation and fire hazards to property purchased by installments when title remains in vendor. This coverage may be extended also to other hazards.
- Installments for Life Option.**—Provides that upon the maturity of a life insurance policy a stated amount will be paid monthly, quarterly, semiannually, or annually for the life of beneficiary, or for a specified period to beneficiary and other specified persons.
- Insurable Interest.**—Exists when beneficiary has reason to desire continuance of life of insured person or property and would suffer economic loss by death or destruction of, or injury or damage to, such subject matter.
- Interest Option.**—Provides that interest at stated rate on amount due on life insurance policy at maturity will be paid monthly, quarterly, semiannually, or annually to beneficiary. The principal sum by agreement is withdrawable or payable to other specified persons on the happening of a specified contingency.
- Internal Revenue Bond.**—Guarantees payment of taxes and compliance with regulations on certain products within the United States, as alcohol, spirits, beer, wine, gasoline, tobacco.
- Joint Life Insurance.**—A form of life insurance which is payable upon the first death of those named as the insured; it is written with various terms to meet individual needs and may be made payable to the survivor or survivors or to a third-party beneficiary. See also

- separate article **LIFE INSURANCE**.
- Judicial Bond**.—See term **Court or Judicial Bond**.
- Leasehold Interest Insurance**.—Provides coverage for holder of long lease if, when cancelled by lessor on happening of a peril, as fire, its rental is less than current rentals.
- Liability Floater**.—Covers legal liability of carrier to shipper or consignee for loss or damage to property transported.
- Liability Insurance**.—A class of insurance embracing those forms that cover legal liability of insured to others for bodily injury, death, or property damage; called also third-party insurance. See also separate article **LIABILITY INSURANCE**.
- License Bond**.—Guarantees compliance with law and regulations by persons engaged in certain enterprises that affect the public interest, as electricians, milk dealers, auctioneers, and amusement park operators.
- Life Insurance**.—See terms **Ordinary Life Insurance**; **Industrial Life Insurance**; also separate article **LIFE INSURANCE**.
- Limited Installment Option**.—Provides that amount due on life insurance policy at maturity with interest will be paid monthly, quarterly, semiannually, or annually to beneficiary for a specified period or in specified amounts till the total is exhausted.
- Limited Payment Life Insurance**.—Provides coverage similar to that of ordinary life insurance, but premiums are due for specified period only, as for 10, 20, or 30 years.
- Loss**.—In insurance, the amount of diminution or destruction of the values of, or the amount of the charge upon, the insured by the direct consequence of the operation of the risk covered, according to the values specified in the policy; it constitutes a basis for a claim against the insurer.
- Lost Instrument Bond**.—Protects issuer of duplicate lost valuable paper against loss through reappearance of original.
- Manufacturers' Public Liability Insurance**.—Covers legal liability of insured for bodily injury or death arising from his business operations, including installing and servicing off premises.
- Marine Liability Insurance**.—Covers legal liability of insured to third parties for loss, damage, or expense arising from ownership, use, maintenance, repair or construction of any craft or instrumentality in use in ocean transportation, including liability for bodily injury, illness, or death.
- Medical Payments—General Liability**.—Provides for the payment of all reasonable expenses incurred within one year from the date of accident for necessary medical, surgical, dental, ambulance, hospital, professional nursing and funeral services to or for each person who sustains injury, caused by accident, and arising out of the insured's ownership, maintenance or use of premises, or his operations.
- Money and Securities Policies**.—One form, *premises all risks* policy, provides coverage against loss of money and securities on premises caused by destruction, disappearance, or wrongful abstraction thereof, and damages to premises caused by robbery or burglary; another form, *messenger all risks* policy, provides coverage against loss of money and securities outside premises in transit by custodian, caused by destruction, disappearance, or wrongful abstraction thereof. Both forms exclude losses caused by dishonest employees, voluntary surrender of the property, or forgery.
- Name Schedule Bond**.—A fidelity bond covering employees listed, each for a fixed amount.
- National Service Life Insurance**.—Offered by the federal government with special provisions as to amounts of protection and terms of payment to men and women in the armed forces during wartime, the extra hazard of military service being assumed as a national risk.
- Nationwide Definition and Interpretation of the Insuring Powers of Marine and Transportation Underwriters**.—Statement approved by National Association of Insurance Commissioners, 1913, revised 1953, to clarify in certain respects the state insurance laws with reference to overlapping insuring powers of insurers, and to coverages involving misapprehension among fire, marine, and casualty insurers. It enumerates (1) conditions under which marine and/or transportation policies may cover imports, exports, domestic shipments, and personal property floater risks; and (2) conditions under which such policies shall not cover property.
- Nonconcurrency**.—Arises when terms of policies are not alike as to items covered, interests insured, or distribution clauses.
- Nonforfeiture Provisions**.—State benefits available to life insurance policyholders upon lapse of policy for nonpayment of premium; they are (1) cash surrender value, (2) paid-up insurance, and (3) extended term insurance. The third usually is automatically operative unless holder selects one of the other two.
- Ocean Marine Insurance**.—Covers vessels, cargoes and freights chiefly against sea perils (sinking, stranding, and collision), and incidental shore and inland risks.
- Old Age Insurance**.—A class of insurance embracing those forms—individual, group, or social—designed to provide financial security for aged persons. See also separate article **PENSION OR RETIREMENT SYSTEM**.
- Open Policy**.—One in which the value of the subject matter insured has not been fixed but has been left to be determined in case of loss, or one in which the risk or subject matter insured is not fixed but is covered by insurer as reported by insured.
- Optional Settlements**.—Ways in which a life insurance policyholder or his beneficiary may elect to have applied the amount payable on the policy at maturity in lieu of one immediate cash payment; they are (1) interest option, (2) limited installment option, and (3) installments for life option.
- Outage Insurance**.—By endorsement on boiler and machinery insurance policy, indemnifies for increased cost of maintaining business without the damaged object.
- Overinsurance**.—Exists when insurance is written in an amount larger than is justified by the risk. It may occur, for example, in life, fire, or accident and health insurance.
- Owners' Landlords', and Tenants' Public Liability Insurance**.—Covers legal liability for bodily injury or death arising from ownership, maintenance, occupation, or use of insured premises.
- Owners' and Contractors' Protective Liability Insurance**.—Covers legal liability of owner or general contractor for bodily injury or death through acts respectively of his contractor or subcontractor.
- Owners' Protective Contract Bond**.—Guarantees owner that construction contract will be performed faithfully and that labor and material-men will be paid.
- Paid-Up Insurance**.—Amount of coverage available to life insurance policyholder upon and after he cancels his policy or permits it to lapse, without further premium payments; it is an optional nonforfeiture value and may not be less than the cash surrender value.
- Parcel Post Insurance**.—Indemnifies shipper for loss through all risks of package, insured or uninsured, registered or unregistered, in custody of Post Office Department till arrival at addressee's premises. There is a reporting form for monthly reports by larger shippers, and a coupon form, 100 to 1,000 coupons, for smaller shippers.
- Partial Disability**.—In accident insurance, injury that prevents insured from performing one or more important duties of his occupation.
- Participating Insurance**.—Refunds to insureds a portion of premiums, representing earnings by insuring company through excess interest received on investments, favorable mortality experience and savings in expenses. In nonparticipating insurance such earnings are anticipated in the premium rates, and company profits benefit the stockholders.
- Particular Average**.—In ocean marine insurance, loss of, or damage to, a particular interest (ship, cargo or freight) which is not general average.
- Partnership Insurance**.—May be written (1) insuring each partner for the amount of his capital, which is thus safeguarded for the use of the firm upon the death of the insured; or (2) insuring the partners in a joint life policy wherein upon the first death the amount is payable to the survivors and the insurance expires.
- Pension Trust**.—Provides income to employees for life after retirement age, premiums being contributed by employer and/or employees; separate policies usually are issued, though blanket policies also are written. See also separate article **PENSION OR RETIREMENT SYSTEM**.
- Permit Bond**.—Guarantees compliance with law and regulations by persons operating on or under public property or in the air.
- Personal Effects Floater**.—Provides coverage for insured and family against all risks, with exceptions, of loss or damage to personal effects, as those of a tourist, with exclusions, in any location.
- Personal Jewelry-Fur Floater**.—Provides coverage for insured and family against all risks, with exceptions, of loss or damage to scheduled jewelry and furs in any location.
- Personal Liability Insurance**.—See term **Comprehensive Personal Liability Policy**.
- Personal Property Floater**.—Covers all personal property, with specified exceptions, of insured and family, wherever located, against all risks of loss or damage, with exclusions in certain cases.
- Power Interruption Insurance**.—Indemnifies for consequential loss or spoilage arising from accident in public utility equipment causing interruption of service.
- Primary Commercial Blanket Bond**.—A fidelity bond providing coverage similar to that of blanket position bond, but differing in that it specifies amount available for any single loss rather than separate amounts for each employee.

- Principal Sum.**—Amount or portion thereof payable in accident insurance policy upon death or specified disability caused by accident.
- Pro Rata Premium.**—Charged when insurer cancels policy, or when insured cancels one policy and takes another with same insurer.
- Probate Bond.**—See term *Fiduciary or Probate Bond*.
- Processing Floater.**—Provides coverage for processor of goods, as cotton, silk and wool, against named perils on premises, and transit risks.
- Products Public Liability Insurance.**—Covers legal liability of insured for bodily injury or death through use, consumption, or existence of his product after he relinquishes it.
- Professional Liability Insurance.**—Covers legal liability of persons, as physicians, surgeons, dentists, and druggists, for bodily injury or death caused by malpractice, errors or mistakes of insured or his nurses or clerks.
- Profits and Commissions Insurance.**—Indemnifies manufacturer or middleman for loss of earned profits or commissions through damage to finished goods resulting from named peril.
- Prospective Restoration Clause.**—After discovery of loss on fidelity bond, restores face amount for losses subsequently occurring.
- Public Liability Insurance.**—A class of insurance embracing those forms that cover legal liability for bodily injury, death or property damage, except liability arising from maintenance, operation or use of automobiles. The common forms are: manufacturers' and contractors' liability; owners', landlords', and tenants' liability; elevator liability; owners' and contractors' protective liability; products liability; and contractual liability.
- Public Official Bond.**—For federal, state and local governments, guarantees faithful performance of official duties by public officials, and safekeeping and accounting of public funds. The form of bond usually is fixed by law.
- Reinstatement.**—Refers to reinstatement of policy amount after loss, or in life insurance to reinstatement of policy after lapsation.
- Reinsurance.**—A contract by which an insurance company procures a third party, commonly an insurance company, to insure it against loss or liability by reason of a policy it has written.
- Rent, Rental Value Insurance.**—Indemnifies owner-occupant when forced to evacuate premises as a result of fire for cost of rent in other premises during period of rehabilitation, or landlord for loss of normal rental income during enforced evacuation of tenants from a similar cause.
- Replacement Cost Insurance.**—Insurance covering on building may be extended by endorsement to cover the difference between the actual cash value and the actual cost of repair or replacement without deduction for depreciation.
- Reporting Form or Policy.**—Covers fluctuating properties or risks, premium being based on periodic reports by insured.
- Representation.**—As applied to insurance, distinguished from warranty. See term *Warranty*.
- Reserve.**—In life insurance, portion of premium set aside and invested by insuring company to build up fund to meet future death claims.
- Residence, Farm Liability Insurance.**—A division of owners', landlords' and tenants' public liability insurance, includes garages and outbuildings, and injuries from pets on premises. Coverage for acts of dog off premises may be added by endorsement.
- Residence and Outside Theft Insurance.**—Indemnifies insured and entire family including guests and servants within premises for loss of property caused by burglary, robbery, theft, or larceny. Outside coverage without charge (except in New York City counties of Bronx, Kings, New York, and Queens) also is included except on guests.
- Retroactive Restoration Clause.**—After discovery of loss on fidelity bond, restores face amount for losses subsequently discovered.
- Reversionary Interest.**—Refers to benefits payable to a named beneficiary upon death of insured; while this term has general and wide application, specific policies, such as reversionary annuities, and deferred survivorship annuities, otherwise known as continuous installment policies, provide for payment of income benefits to a named beneficiary at death of the insured.
- Rider.**—A printed agreement attached to an insurance policy.
- Scheduled Property Floater.**—Provides coverage against loss or damage to a variety of named items of mobile property in any location, arising from specified or all risks.
- Securities Insurance Policy (for Lessees of Safe Deposit Boxes).**—Provides coverage against loss caused by destruction, disappearance, or wrongful removal of securities in, or from, leased safe deposit boxes. It excludes losses caused by dishonest employees or authorized representatives of the insured, or by voluntary surrender of the property by them or by the insured.
- Securities Policy.**—Provides coverage for financial institutions and brokerage houses against specified losses caused by defective securities. This coverage commonly is incorporated in bankers' and brokers' blanket bonds.
- Settlement Options.**—See term *Optional Settlements*.
- Short Rate Premium.**—Charged for less than one year, or when policy is cancelled by insured without reinsuring in same insurer.
- Single Premium Life Insurance.**—Provides coverage similar to that of ordinary life insurance, with total premium obligation paid in one amount.
- Social Insurance.**—A general class of insurance embracing those forms designed to protect wage earners and their dependents, as workmen's compensation, old age, unemployment, accident and health insurance.
- Specific Policy or Form.**—Covers at a specific location against hazards insured.
- Sports Liability Insurance.**—Covers legal liability of insured for bodily injury or death arising from his activity in athletic sport or game, except professional activity.
- Superseded Suretyship Rider.**—Endorsement on new fidelity bond, providing continuous coverage with replaced bond.
- Supplemental Contract or Deposit Receipt.**—Is in effect a receipt issued by a life insurance company to a claimant under a life insurance policy for funds held for the claimant's benefit under settlement options, (1) interest, (2) life annuity, 10, 15, or 20 years certain, (3) payment of principal and interest over a specified period of years, or (4) a specified income for as long as the proceeds will last.
- Supply Bond.**—Guarantees that supplier of goods will perform terms of his contract.
- Suretyship.**—An undertaking by one party (the *surety*) guaranteeing performance by another party (the *principal*) of an obligation with a third party (the *obligee*).
- Surrender Value.**—See term *Cash Surrender Value*.
- Teachers' Liability Insurance.**—Covers legal liability of teachers and faculty members for bodily injury or death arising from personal acts in connection with their profession.
- Term Insurance.**—Provides coverage for a specified period, the policy amount being payable if insured dies during the period.
- Third-Party Insurance.**—See term *Liability Insurance*.
- Time Policy.**—In ocean marine insurance, provides coverage for vessel or cargo or both for a specified period of time.
- Title Insurance.**—See separate article *TITLE INSURANCE*.
- Tontine Policy.**—Provides that at the end of a specified period the surplus fund shall be distributed among those in their class who have kept their policies in force, the lapsing members of each class forfeiting their rights and receiving nothing and the reserve values of their lapsed policies being credited to the surplus fund.
- Total Disability.**—In accident insurance, injury that prevents insured from performing any and every duty of his occupation.
- Total Loss.**—In ocean marine insurance, a total loss occurs when the subject matter is entirely destroyed or so damaged that it is of no use or value to the insured, or when the insured is deprived entirely of his property; see term *Constructive Total Loss*. In fire insurance, a total loss occurs when the subject matter loses the essential character of the property insured; complete physical destruction usually is not required by the term, provided the remaining portion, though unburned, cannot profitably be utilized.
- Transportation Insurance.**—A general class of insurance embracing those forms that indemnify for losses arising from transportation risks. In inland marine insurance, it is the basic form of in-transit coverage with many optional endorsements or riders for specific coverages.
- Underwriter.**—See separate article *UNDERWRITER*.
- Unearned Premium Endorsement.**—Indemnifies for loss of portion of paid premium caused by reduction of policy amount through loss.
- Unemployment Insurance.**—A class of insurance embracing those forms designed to provide relief for wage earners and their dependents during periods of unemployment.
- Unknown Hazards.**—A hazard within the scope of the coverage but the existence of which with respect to the individual risk is unknown.
- Use and Occupancy Insurance.**—See term *Business Interruption Insurance*.
- Valued Policy.**—States within the instrument itself the amount to be paid in case of loss, thus avoiding determination of such amount after loss by appraisal or adjustment.

- Vessels, Hull Insurance.**—Covers ocean-going vessels, yachts, barges, and tugs on annual basis or for specific voyages.
- Voluntary Workmen's Compensation.**—Standard workmen's compensation policy may be endorsed to cover bodily injury or death of employees whose duties do not come within scope of any workmen's compensation law. When so endorsed policy provides for voluntary payment on behalf of insured employer of same benefits to or for such employees as would have been paid if injury or death had been sustained in an employment included in such law.
- Voyage Policy.**—In ocean marine insurance, provides coverage for vessel or cargo or both from one designated port to another; more than one voyage may be covered in one policy.
- Wager Policy.**—In insurance, one in which the insured has no insurable interest in the subject matter insured; being considered generally as a form of gambling, such a policy is not valid except where the validity of a wager may be recognized. In ocean marine insurance, agreements, often called "honor agreements," may be written where the interest of the insured is difficult or impossible to prove.
- Warehouse Bond.**—Guarantees validity of receipt given for property by warehouseman, or payment of duty and taxes, and compliance with regulations, on property received by warehouseman.
- Warranty.**—As applied to insurance, a statement or engagement by insured which if not true or fulfilled voids the insurance contract. It is distinguished from a representation, which is an inducement and need be only substantially true or fulfilled.
- Workmen's Compensation Insurance.**—See separate article **COMPULSORY INSURANCE**; **SOCIAL SECURITY—Workmen's Compensation**.

INSURANCE, Accident. See **ACCIDENT INSURANCE**; **LIABILITY INSURANCE**.

INSURANCE, Automobile. See **LIABILITY INSURANCE**.

INSURANCE, Aviation. See **LIABILITY INSURANCE**.

INSURANCE, Burglary. See **BURGLARY INSURANCE**.

INSURANCE, Credit. See **GUARANTY INSURANCE**.

INSURANCE, Crop. See **CROP INSURANCE**.

INSURANCE, Fidelity. See **SURETYSHIP**.

INSURANCE, Fire. See **FIRE INSURANCE**.

INSURANCE, Group. See **GROUP INSURANCE**.

INSURANCE, Guaranty. See **GUARANTY INSURANCE**.

INSURANCE, Health. See **HEALTH INSURANCE**.

INSURANCE, Industrial. See **INSURANCE—Insurance Terms** (Industrial Life Insurance).

INSURANCE, Liability. See **LIABILITY INSURANCE**.

INSURANCE, Life. See **LIFE INSURANCE**.

INSURANCE, Marine. See **INSURANCE—Insurance Terms** (Inland Marine Insurance) and **Marine Liability Insurance**.

INSURRECTION, in-sŭ-rĕk'shŭn, the art of rising against political authorities. In the United States, power to suppress insurrections by employing the militia is given to Congress by the

Constitution, Article I, section 8, clause 15. In 1792 and 1807 acts were passed giving the president power to call forth the militia when notified by an associate justice of the Supreme Court or a district judge that the execution of the laws is obstructed, and on application of a legislature or a governor, when the legislature could not be convened, and to employ also the land and naval forces of the United States. The Whiskey Rebellion was directed against the federal authority and the president employed force to suppress it on notification by the federal judge. During the Buckshot War (q.v.), in 1838, between the Whigs and Democrats in Pennsylvania, the governor of that state asked for assistance, but it was refused. The governor of Rhode Island made a similar application during Dorr's Rebellion (q.v.) and the regulars were held ready for action, but their aid proved unnecessary. These last two cases came under Article IV, section 4, of the federal Constitution, which provides "that the United States shall protect" each state on application of the legislature, or of the executive, against domestic violence.

When the Civil War began the president was obliged to take prompt steps in calling out the militia, though no application had been made to him as required by the acts of 1792 and 1795. His action was justified by Article II, section 3, of the Constitution, providing that "he shall take care that the laws be faithfully executed," but Congress on Aug. 6, 1861, formally validated and made legal all of President Lincoln's previous acts, proclamations and orders. The Force Act of April 20, 1871, gave the president special power to use military force in certain contingencies. In the South during the reconstruction period, and in the North during strike riots, federal troops have been used.

INTAGLIO, in-tă'l'yō, a method of cutting a stone or gem by which the design is cut or hollowed out—not raised, as in a cameo. In art, the term means the opposite of relief, denoting the representation of a subject by hollowing out a gem or other substance, so that an impression from the engraving has the appearance of a bas-relief. Intaglio letters have been effectively used in printing in recent years, and much of the effectiveness of colored printing is due in large measure to a process or processes closely akin to intaglio. See also **GRAPHIC ARTS—Glossary of Graphic Arts Terms** (Intaglio), (Rotogravure).

INTEGRAL CALCULUS. See **CALCULUS**—5. *The Indefinite Integral*; 6. *The Definite Integral*.

INTEGRAL EQUATIONS. See **EQUATIONS**—4. *Integral Equations*.

INTEGRATION. See **SEGREGATION IN THE UNITED STATES**.

INTELLECT. See **INTELLIGENCE**.

INTELLECTUALISM, in philosophy, theories which emphasize the intellect as contrasted with the affective and volitional aspects of consciousness. In philosophy it applies, for example, to Johann Friedrich Herbart's doctrine of presentations, in which cognitive experiences are made primary in the explanation of mind. The historical antithesis between sensation and

intellect gives the term intellectualism to theories which find the ultimate nature of reality in some form of thought or reason. By some reality is reduced to intellectual relations. In aesthetics the view of intellectualism regards the ideas suggested by an object as the important factors in beauty. Recent philosophic thought, however, is departing from the crass intellectualism of even a few years ago. Henri Bergson is the greatest figure who has opposed intellectualism in our day.

INTELLIGENCE, ĭn-tĕl'ĭ-jĕns, the ability to make effective use of past experiences in adjusting to new situations. In traditional mental philosophy intelligence was defined as a trait uniquely human, and the behavior of animals was thought to be directed by instincts. Human beings, therefore, were thought to be able to master the environment through the exercise of the faculty of intelligence.

Teachers have always recognized the fact that some pupils learn with ease and that others have serious handicaps in ability to master the curriculum. The first successful measure of differences in ability to learn was used in 1904 by Alfred Binet (q.v.) and Theodore Simon in an inquiry into the problem of retardation in French elementary schools. Their novel technique attracted worldwide attention. The famous Binet-Simon Scale was published in 1905 and revised in 1908 and 1911 to incorporate suggestions made by psychologists here and abroad.

Among those who adapted the procedure for use in studies of American school children was Lewis Madison Terman (1877-1956). His test, published in 1916 and revised in 1937, became the most widely used measure of intelligence in America. Whereas Binet was not concerned with a definition of intelligence, Terman wrote that it is the ability to make use of abstract concepts. This definition aroused much discussion. Many other definitions were proposed, but none of them was wholly acceptable to educators and psychologists.

Following World War I, psychologists commenced to write about a number of specific abilities rather than of a single trait labeled intelligence. It was noted that the conventional measures of intelligence seemed to appraise the level of ability to learn the school curriculum, especially the conventional academic studies. Measures of performance in dealing with form-boards, puzzles, and mechanical devices yielded scores that were sometimes different from those obtained from verbal tests. It was also noted that a person might do fairly well on both verbal and nonverbal tests of intelligence, but make a low score on a measure of social intelligence. Hence, three different types of intelligences were more or less vaguely defined: verbal, mechanical or nonverbal, and social.

Research centered upon the analysis of intelligence-test scores and their relationship to sex, race, environment, family background, teachers' marks, and afterschool life-careers. Impetus to the use of group tests of intelligence was given by the measures used in the United States Army during World War I. Debates about an unambiguous definition of intelligence were of less interest than efforts to accumulate scores on intelligence tests and to interpret the meanings of these data.

Binet had worked out a technique for evaluating a person's intelligence by comparing his level of success on test items with that achieved

by the average individual of a known chronological age. Thus, if a child passed all the tests passed by the average child six years of age, his mental age (M.A.) would be six, regardless of his chronological age (C.A.). Louis William Stern (1871-1938) suggested that intelligence-test results might be expressed in terms of a ratio between mental age and chronological age. Terman popularized this method. The scores are converted into I.Q.'s by the formula: M.A./C.A. times 100. Thus, an I.Q. of 80 represents a deficit, and an I.Q. of 120 an excess, of intelligence.

In recent years psychologists have shifted their interests from attempts to measure intelligence, loosely defined as a single trait, over to diagnostic tests of specific abilities. Both here and abroad there has been developed a set of techniques for measuring what are often referred to as primary mental abilities. Scores on these tests have proved to be helpful in the selection of personnel for industry and military assignments as well as in educational guidance.

A plurality of abilities, not a single trait labeled general intelligence, seems to be of importance in predicting a person's likelihood for success or failure in any given field of endeavor. Among the primary mental abilities that now receive attention are the following: verbal comprehension, rote memory, word fluency, number facility, ability to visualize spatial relations, and perceptual speed and accuracy. These patterns of intelligences have been carefully studied by Louis Leon Thurstone (1887-1956), of the University of Chicago.

It is obvious that intelligence is a difficult term to define. It may very well be plural, not singular, in meaning. The interest continues in the development of predictive scales and tests for the appraisal of abilities. Enthusiasms for theoretical discussions about the nature of intelligence, or intelligences, have greatly diminished both in this country and abroad. Recent investigations have raised grave questions about the traditional dogmas. For instance, it was once assumed by many persons that heredity is the principal determinant of the IQ and that native intelligence reaches its maximum at about age 15 or 16. Considerable doubt has been raised about these inferences and also about the constancy of the IQ as well. For intelligence in animals see **ANIMAL PSYCHOLOGY**; also **EDUCATIONAL PSYCHOLOGY**; **MENTAL TESTS**.

Consult Anastasi, A., *Psychological Testing* (New York 1954); Hilgard, E. R., *Introduction to Psychology*, chap. 18 (New York 1957).

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INTELLIGENCE, Military. See **MILITARY INTELLIGENCE**.

INTELLIGENCE IN ANIMALS. See **ANIMAL PSYCHOLOGY—Memory and Reasoning**.

INTELLIGENCE TESTS. See **MENTAL TESTS**.

INTER-AMERICAN HIGHWAY. See **PAN-AMERICAN HIGHWAY**.

INTERCALARY, ĭn-tŭr'kă-lĕr-ĭ, in chronology, the day added to February in leap year, also the month or days occasionally inserted in the calendar to make it correspond with the solar

year. See also CALENDAR.

INTERCESSION, Doctrine of, a theological tenet founded on the Scriptural representation of Christ who, having made the redemption an accomplished fact on earth, ascended to plead with His heavenly Father for the sinners redeemed by the shedding of His blood. We are not to suppose that God needs to be interceded with in the sense that he is reluctant to pardon sinners, or that he becomes more disposed to do so through the pleading of Christ. Since it is evident from the whole tenor of the New Testament, as well as from a multitude of special passages, that the sacrifice of Christ on Calvary for the reconciling of sinners unto God was itself the offering of God's own love to the world (John 3:16-17), we must regard the intercessory work of Christ rather as illustrating the eternal holiness of God and the changeless love of the Saviour, and as intended to keep continually in view the sacrifice of atoning grace whose tender mercy it develops. This doctrine is common alike to Catholics and Protestants. Catholics, however, believe that the Blessed Virgin and the saints intercede indirectly through the Saviour, who alone has the ear of the King of the universe. Mohammed is regarded as a powerful intercessor by his followers.

INTERCOASTAL WATERWAY OR INTRACOASTAL WATERWAY, and GULF INTRACOASTAL WATERWAY. The first is a protected waterway comprising interconnected canals, bays, inlets, and rivers extending 1,000 miles along the Atlantic coast of the United States. From Trenton, N.J., to Melbourne, Fla., the channel has a 12-foot draught; thence to Miami, 8-foot, and from Miami to Key West, 4-foot. The Gulf Intracoastal Waterway provides a navigable channel with 12-foot depth from Carrabelle, Fla., to Brownsville, Texas, also about 1,000 miles.

INTERCOLUMNIATION, in-tēr-kō-lŭm-nŭ-ā'shŭn, in architecture either (1) the space between two adjacent shafts of a colonnade, or (2) the ratio of the greatest diameter of the shaft to the distance between shafts at the base or (sometimes) between the centers of the shafts.

Marcus Vitruvius Pollio enumerated five varieties of intercolumniation, according to the number of times the bottom diameter of the shaft appeared between the nearest points of adjacent columns. Thus (1) pycnostyle employs $1\frac{1}{2}$ diameters; systyle 2 diameters; eustyle $2\frac{1}{4}$ diameters; diastyle 3 diameters; and areostyle 4 diameters. Claude Perrault (1613-1688) on the Louvre, and repeated by Christopher Wren (1632-1723) on St. Paul's Cathedral is known as areostyle, wherein columns are paired, with $\frac{1}{2}$ diameter between member shafts and $3\frac{1}{2}$ between pairs.

Intercolumniation in the Ionic and Corinthian styles is usually greater than in Doric, where the distance between nearest parts of shafts was sometimes less than one diameter.

To the later ancients the eustyle ($2\frac{1}{4}$ diameters) was the most satisfactory proportion. Vitruvius held that the minimum absolute space between columns should be such as to allow the passage of two matrons arm in arm.

JOHN P. SEDGWICK.

INTERDICT, in-tēr-dĭkt, an ecclesiastical decree which forbids the performance of certain

acts of public worship. When an interdict was laid upon a town, district or country, all the churches were closed, the bells were silent, the sacraments, except infant baptism and extreme unction (and sometimes even these), were withheld, the rites of burial were not performed and all the public ceremonies of religion were suspended. Interdicts may be general, as applied to a country or city; particular, as applied to a parish or diocese; personal, as applied to a person, or some class of persons. In 997 Gregory V laid the kingdom of France under an interdict because King Robert had married his cousin, and the king was abandoned by most of his court. The same penalty was inflicted upon the kingdom of England under Stephen (1147) by Eugenius III, under John (1207) by Innocent III, under Henry VIII (1535) with little effect by Paul III and under Elizabeth (1587) by Sixtus V. Adrian IV laid Rome under an interdict for the purpose of compelling the Romans to drive out Arnold of Brescia. Gregory IX made use of the same instrument of compulsion in his quarrel with the Emperor Frederic II. During the Middle Ages the interdict was a powerful engine of attack for the popes in their contests with sovereigns, as the popular dread of its effects was so great that kings were often forced by rebellions to submit to almost any conditions in order that it might be taken off. From the time of the Reformation general and local interdicts have become rare. When Paul V laid Venice under an interdict in 1606, the churches were not closed, and only a minority of the bishops submitted to it.

INTERDICT, in Scottish law, an order issued by the Court of Session to stay or prohibit a person from an act presumed to be illegal or wrongful. It is similar to the injunction in English and American procedure. See also INJUNCTION.

INTEREST, in-tēr-ĕst, a charge for the use of money. It is usually expressed as a percentage of the amount loaned, and is computed on an annual basis. Interest is charged by those who have money to lend because they give up its use for a specified period of time. Interest can be paid because the borrower anticipates a greater return, in income or other benefits, than he contracts to pay.

Interest has not always been considered a legitimate, or even moral, payment. Until the end of the Middle Ages, any charge for a loan was generally considered to be usury. The teachings of the Christian, Judaic, and Islamic religions all condemned in varying degrees the taking of interest. In more recent times, however, usury has come to be regarded as only the charging of illegal rates of interest (see USURY). The taking of interest for a loan is now almost universally regarded as a legitimate aspect of economic activity.

The shift in attitude toward the payment of interest stemmed from a change in the economic pattern of Western society in particular. This led to an altered view of the nature and function of money. The Aristotelian and Biblical views held that "money is barren." That is to say, money was regarded as only a medium of exchange. The loan of money was considered to be in the nature of a sale. As it was not legitimate to sell a loaf of bread to a man and then charge him for the use of it, so it was not legitimate to

sell money and also charge for its use. The proper price, according to doctrine through the Middle Ages, was simply the return of the same money. Any greater payment was termed immoral, and called usury.

The development of commerce on a widespread basis led to a gradual breakdown of the interdictions against interest. As increased industry and commerce afforded greater opportunities for profit, loans were more actively sought. Traders, merchants, and businessmen were willing to pay interest because they anticipated a greater return from the employment of the borrowed funds. Thus, as the practice of borrowing and lending at interest became more widespread, there arose a number of exceptions or modifications which in fact tended to break down the prohibition of usury or interest-taking. In theory, however, these modifications were merely variations necessary for the fuller attainment of the idea of justice.

Since interest is a price—the price for the use of money—it is determined by the forces of supply and demand. Explanations or theories of the origination of interest must therefore state clearly why interest must be paid and how interest can be paid. In the development of interest rate theory, the latter approach was emphasized first historically, and by many years.

The first formal, theoretical justification of interest was a demonstration that the use of money could be productive of income. Although fragmentary indications were prevalent in earlier writings, the productivity approach to interest theory really developed with Adam Smith (1723–1790). Despite many variations, the basic thesis is that money will be borrowed, and interest paid, so long as the return that can be earned on the borrowed funds exceeds the interest rate. Interest was therefore paid because income could be derived from the use of money.

The supply side of interest rate theory was first treated systematically by Eugen Böhm-Bawerk in the 1880's. His was a time-preference, or abstinence, theory. According to it, the worth of a sum of money presently held is greater than the worth of that same sum payable at some time in the future. The preference of the lender for money to use now over money promised in the future causes him to require some premium.

Modern economic analysis has added variations to these basic approaches. John Maynard Keynes (1883–1946) has argued that interest stems directly from the supply of and demand for money itself, rather than the use of money. His theme is that liquidity is the unique characteristic of money, and he calls the demand for money to hold "liquidity preference." It is this which requires the payment of interest.

More recently, the loanable funds approach has combined the three basic approaches outlined above. It considers interest as a function of supply and demand for loanable funds, which are that portion of the money supply available for lending purposes. The elements of both supply and demand, as well as the influence of liquidity preference, are brought together in this approach.

The interest rate discussed here is the pure, riskless payment for the use of money. Interest payments made in actual practice also include charges for risk and for reimbursement of administrative expense. Variations in risk and in lending cost lead to a whole range of interest rates called the pattern of rates. At the base of

each element in this pattern, however, is the pure, riskless rate of interest determined by productivity, time preference, and liquidity preference.

The payment of interest is a contractual matter. The concept of usury still prevails, however. Society has set limits on what may be considered legitimate compensation for lending money. Any payment beyond that is usury, which is illegal. The recipient of usurious interest may be subject to a fine, a suit for damages, or both, depending on the jurisdiction. In the United States, the several states have established contract and legal limits for interest rates, and in addition have established the penalties for violation of the usury laws.

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INTERESTS AND THEIR MEASUREMENT. Interests are revealed in the specific choices one makes in various situations. A verbalized interest in some vocational field may reflect nothing more than acceptance of some popular stereotype derived from motion pictures. Paucity of information about the specific choices made by successful persons in various occupational fields may mislead a person who is trying to select a career. For such reasons, a group of psychologists at the Carnegie Institute of Technology began to study the possibility of measuring patterns of interest among successful men and women in a number of vocational fields. This work, initiated in 1919, was continued by Edward K. Strong, Jr.; and it led to the development of a paper-and-pencil inventory known as the *Strong Vocational Interest Blank*, the first edition having been published in 1927.

More than 400 occupations, amusements, school subjects, types of persons, activities, and self-appraisals of traits are to be marked "like," "indifferent," "dislike." Each choice has a numerical value, determined from the scores of successful and well-adjusted persons in different occupational fields. Hence, it is possible for a student to determine whether or not this pattern of interests actually conforms to the pattern of those who are happy in their vocation. Since patterns of interests tend to remain fairly stable after age 20, the *Strong VIB* is often used in employment offices and in college guidance laboratories. Follow-up investigations, both by repetitions of the inventory and by later careers of those who have been tested, indicate that this measurement has satisfactory validity.

More than 30 other inventories of interests and preferences are available. Some of them are, like the *Strong VIB*, intended to be used in vocational guidance. Others have been devised for use with small children for research purposes. Children choose among pictures, objects, or activities. Thus, they reveal interests which might not be dependably verbalized if they were questioned directly. Psychologists are interested in patterns of interests among children of different types of home backgrounds, cultural opportunities, sex,

intelligence, and so on. In 1912 Edward Lee Thorndike reported that retrospective accounts of interest patterns reveal a rather high consistency from primary school through college years. He also observed that clergymen seem to have a growing interest in their calling, whereas in other fields of endeavor interest patterns tend to remain stable. Robert Hoppock, on the other hand, reported in 1935 that one-third of all employed persons are uninterested in their jobs.

Much attention has been paid to Eduard Spranger's discussion of value-interest types of personalities. In his *Lebensformen* (*Types of Men*, trans. 1928), Spranger takes the idealistic point of view that all men are admixtures of six value-interests, with one pattern tending to be more or less dominant. Intellectualistic pursuit of truth (the theoretical type); concern for the practical, the useful (economic type); interest in the artistic phases of life (aesthetic); love of human beings (social); leadership and power (political); and mysticism (religious type) are said to be the basic value-interests. For purposes of group discussion about the Spranger types, as well as for research studies of these patterns of value-interests, an inventory known as *Study of Values* (Boston 1951) has been published. Some evidence has been cited to indicate that the interest patterns, as Spranger has defined them, alter as life experiences vary.

PHILIP L. HARRIMAN.

INTERFERENCE, ĩn-tēr-fēr-ēns, the effect that trains of waves have upon one another when they meet. The waves may be water, sound, light, or electromagnetic. The effect may be either to increase or to decrease intensity, depending upon whether the crests and troughs of the waves coincide at the point of meeting or tend to neutralize one another.

The phenomenon may be observed when two different trains of waves come together on the surface of water. When the crest of a wave of one system coincides with the crest of a wave of the other system, the elevation of the surface is equal to the sum of the heights of both waves. When a crest of one wave coincides with the trough of another, surface disturbance is reduced and the elevation or depression is equal to the difference between the height and depth of the separate waves. The same rule governs when intermediate wave parts meet.

This phenomenon is of the same general sort with sound, light, and electromagnetic waves. When waves emanating from separate sources are of the same length and their crests and troughs reach a given point at the same time, they reinforce each other; when the difference in time is a half wave length, they cancel.

A familiar result, with sound waves of but slightly different lengths moving in nearly the same direction, is the production of "beats." With light waves, it can be observed on soap bubbles. Light striking a bubble is reflected toward the eye from both the inner and outer surfaces in trains of waves having slightly different phases. In monochromatic light, the effect appears as dark lines where the trains nearly or completely neutralize one another; in white light, the dark lines are replaced by bands of its various color components.

Interference is relied upon in the operation of radio beacons and the like for producing concentrated beams through the focusing of electro-

magnetic waves. Coming from two or more special antennas, the waves augment one another in the direction in which the crests and troughs coincide, and they are weakened or neutralized in the other directions.

In radio and television broadcasting, another type of interference occurs when stray electrical waves become mixed with the transmitted signals and reach the receiver as noise or as disfigurements of the image on the screen. They may be either from natural causes, such as lightning, or from electrical equipment.

In *mechanics*, the term is applied to certain gear designs, where the tip of a tooth of one gear tends to occupy the same space as the flank of the tooth of a mating gear, causing undercutting of the flank and rounding of the tip. It is overcome by modification of the tooth profiles. See also WAVES AND WAVE MOTION; LIGHT; ACOUSTICS; VIBRATION; RADIO; TELEVISION; GEARS.

INTERFEROMETER, ĩn-tēr-fēr-əm-ē-tēr, an instrument utilizing the interference patterns of light waves for precise measurements of wave lengths and of minute distances and thicknesses. It is also used in the study of the structure of spectrum lines, in determining indices of refraction, and in testing lenses, and has been employed in the measurement of double-star separations and the diameters of very large stars.

The best known was devised by the American physicist Albert A. Michelson (1852-1931). It consists of two mirrors that cause two light beams to come together at a point of interference between their waves. A micrometer screw on one of the mirror mounts provides for close adjustment. Another in use, the Fabry-Perot interferometer, utilizes multiple reflections between two surfaces, as does the less complicated but limited Lummer-Gehrcke plate. See also SPECTROSCOPY—*Spectroscopic Instruments*.

INTERGOVERNMENTAL COMMITTEE FOR EUROPEAN MIGRATION (ICEM), an international organization with headquarters in Geneva, Switzerland, which was created in Brussels in December 1951 at a conference called by the Belgian government at the suggestion of the United States. The ICEM was conceived as an instrument to restore the equilibrium between Europe's overcrowded countries, as Italy and the Netherlands, and undermanned countries in other continents through governmentally assisted migration. The persons assisted include political refugees. Though outside the framework of the United Nations, the ICEM maintains close working relationships with the U.N. and its specialized agencies dealing with migration. A policy-making council representing all 27 member governments normally meets twice a year. In 1957 the director of the ICEM was H. H. Tittmann of the United States.

INTERIM, ĩn-tē-rĭm, in the history of the Reformation, the name of several compromises forced on the German Protestants by edicts of Charles V, especially that of 1548, regulating religious and ecclesiastical matters "in the meantime," until they could be decided by a general council. The *Ratisbon Interim* was drawn up in 1541 by a commission which included Johann Eck, Martin Bucer, Julius von Pflug, John Gropper, Johannes Pistorius, and Melancthon (Philipp Schwarzerzt). Many doctrinal points

were smoothed over, but the differences in regard to the ecclesiastical power and the sacraments were too great to be reconciled. By the Protestants in general, the whole movement was looked on as a scheme to entrap them into a formal return to the Roman Catholic Church. In 1548 at Augsburg, the emperor appointed Johannes Agricola, Michael Helling, and von Pflug to prepare a new interim. This *Augsburg Interim* conceded to the Reformers communion in both kinds, and the marriage of priests. Great opposition developed in North Germany and the pact was revoked in 1552. Elector Maurice of Saxony secured the adoption of the *Leipzig Interim* in 1548, according to which the Protestant creed remained intact, with an admixture of the old ceremonial; the papal and episcopal powers were also recognized to a limited extent.

INTERIOR, Department of the. A major department of the executive branch of the United States government, the Department of the Interior was created by Act of Congress on March 3, 1849. The secretary of the interior is a member of the president's cabinet.

SECRETARIES OF THE INTERIOR

Name	Term of service	Presidents under whom served
Thomas Ewing	1849-1850	Taylor
James A. Pearce	1850	Fillmore
Thomas M.T. McKennan	1850	Fillmore
Alexander H.H. Stuart	1850-1853	Fillmore
Robert McClelland	1853-1857	Pierce
Jacob Thompson	1857-1861	Buchanan
Caleb B. Smith	1861-1863	Lincoln
John P. Usher	1863-1865	Lincoln,
		A. Johnson
James Harlan	1865-1866	A. Johnson
Orville H. Browning	1866-1869	A. Johnson
Jacob D. Cox	1869-1870	Grant
Columbus Delano	1870-1875	Grant
Zachariah Chandler	1875-1877	Grant
Carl Schurz	1877-1881	Hayes
Samuel J. Kirkwood	1881-1882	Garfield
Henry M. Teller	1882-1885	Arthur
Lucius Q.C. Lamar	1885-1888	Cleveland
William F. Vilas	1888-1889	Cleveland
John W. Noble	1889-1893	B. Harrison
Hoke Smith	1893-1896	Cleveland
David R. Francis	1896-1897	Cleveland
Cornelius N. Bliss	1897-1899	McKinley
Ethan A. Hitchcock	1899-1907	McKinley,
		T. Roosevelt
James R. Garfield	1907-1909	T. Roosevelt
Richard A. Ballinger	1909-1911	Taft
Walter L. Fisher	1911-1913	Taft
Franklin K. Lane	1913-1920	Wilson
John B. Payne	1920-1921	Wilson
Albert B. Fall	1921-1923	Harding
Hubert Work	1923-1928	Harding,
		Coolidge
Roy O. West	1928-1929	Coolidge
Ray Lyman Wilbur	1929-1933	Hoover
Harold L. Ickes	1933-1946	F.D. Roosevelt,
		Truman
Julius A. Krug	1946-1949	Truman
Oscar L. Chapman	1949-1953	Truman
Douglas McKay	1953-1956	Eisenhower
Fred A. Seaton	1956-1961	Eisenhower
Stewart L. Udall	1961-	Kennedy,
		L.B. Johnson

The duties and responsibilities of the secretary are shared by an undersecretary and five assistant secretaries. *The assistant secretary for water and power development* supervises the Bureau of Reclamation, Bonneville Power Administration, Southwestern Power Administration, Southeastern Power Administration, Office of Saline Water, and the Defense Electric Power Administration. *The assistant secretary for min-*

eral resources is responsible for the Bureau of Mines, Office of Geography, Office of Minerals and Solid Fuels, Office of Oil and Gas, Office of Minerals Exploration, Office of Coal Research, Oil Import Administration, and Geological Survey. *The assistant secretary for public land management* coordinates the functions of the Bureau of Land Management, Bureau of Indian Affairs, National Park Service, Office of Territories, The Alaska Railroad, and the Bureau of Outdoor Recreation. *The assistant secretary for fish and wildlife*—a post created in 1956 by act of Congress—is responsible for the Bureau of Sport Fisheries and Wildlife and the Bureau of Commercial Fisheries. *The administrative assistant secretary* supervises the divisions of administrative services, budget and finance, management research, personnel management, property management, security, and survey and review.

The department's chief responsibility is the conservation and development of the nation's land, water, and mineral resources. Originally, its two main branches were the General Land Office and the Office of Indian Affairs. Its major role in the 1800's was to develop the western areas of the United States. In its early years it also handled pensions and patents, and was responsible for taking the national census. Education, labor, and interstate commerce came under its jurisdiction at various times. It has been called the "mother of departments" because four government departments of cabinet rank—agriculture, commerce, labor, and (less directly) health, education, and welfare—evolved from the Department of the Interior.

As the nation's primary land agency, the department is directly responsible for managing almost 500 million acres of land in the United States and its territories. It also administers those areas of the Outer Continental Shelf that the Supreme Court may adjudge to be federal land. The department is responsible for mapping the physical features of the country; for protecting and preserving national parks, monuments, and historic sites; and for promoting the conservation and development of fish and wildlife resources.

The department conducts programs and helps industry carry out plans to explore and develop mineral resources to meet the nation's growing demands. It helps to assure adequate supplies of energy and to develop irrigation and multipurpose hydroelectric projects. It markets the electric power produced by all federal agencies except the Tennessee Valley Authority. In addition, it exercises certain mobilization functions related to national defense, chiefly for minerals, fuels, and electric power. The department is also responsible for the welfare of Alaskan Eskimos, widely scattered island populations, and more than 300,000 Indians.

INTERIOR DECORATION, the creative art which fulfills a basic urge to create beauty, comfort, and utility in the immediate environment, affording an opportunity for the decorator, as artist, to evoke—in every case—a latent artistic effect difficult to express. The reason for this difficulty is that the instinct to decorate—stronger in one person than in another—is never completely gratified because no decorative project, once it is begun, is ever permanently completed. The professional decorator must develop discriminating taste through studies of historic and contemporary

styles (see FURNITURE; FURNITURE, AMERICAN; FURNITURE, MODERN), and must be capable of creating original decorative schemes through comprehensive technical ability acquired only by long training and experience.

In its scope interior decoration includes—in its *residential* phase—the choice of designs for houses and apartments, as well as—in its *contract* phase—offices, clubs, hospitals, ships, theaters, restaurants, hotels, and other public buildings. The selection of appropriate color and pattern is as important in developing a decorative scheme as the textures and materials used. In its more comprehensive practice—of which only persons interested in it as a career need be concerned—

for practical needs. Information in the subject, however, is dependent upon the mutations of the times, because as old styles are discarded and new methods and techniques developed in their stead, there is a more flexible technique for decorating an interior that fits a corresponding more relaxed and flexible way of living: the occupant of a house or apartment is induced to express ideas in decoration not by rote, but for his own use and as a part of his own experience. The result is that an interior, instead of resembling a museum setting, acquires individual character and fresh interest.

Virtuosity is required in adapting interior decoration to the varying tempo of contemporary



A living room of the early Victorian period.

Courtesy The Metropolitan Museum of Art

interior decoration is both a profession and a business, predicated upon merchandising and actual planning for living and working, with the business consisting mainly of selling interior furnishings, and the profession dealing with the skills of creating, or designing, complete interiors.

For the convenience of the reader, this article is divided into two sections:

1. Residential Interior Decoration
2. Contract Interior Decoration

1. RESIDENTIAL INTERIOR DECORATION

Opportunities in a fresh approach to decorating are enhanced by custom which, in the course of years, has changed the procedure from stylistic period decoration to the modern one of decorating

living. The professional decorator can, as in the past, make his own rules and depend upon his own taste for the achievement of desired results in decorating a room. The novice, however, is on safer ground in following the prescribed rules laid down through the years by trial and error.

Not least among the attractions of interior decoration is the diversity of its expression—the seemingly inexhaustible range of styling in furniture, fabrics, wallpapers, and floor coverings of every historical period—by which certain decorative effects are obtained.

Basic Principles.—The successfully decorated home—whether it is a house, an apartment, or a single room—is the most important material thing in one's life if it is to express the person-



Living room decorated in early American style by C. Eugene Stephenson shows lamp contrived from an old brandy jug and supplementary rheostat-controlled indirect lighting from behind antique carved figure over the fireplace.

ality of the occupants and be the perfect background for a social life bringing joy and contentment. It does not depend upon costly furnishings and great expense, but it does require assured knowledge of the basic principles of interior decoration and something of good taste.

The basic principles of design have existed for several centuries, and are likely to continue although they may appear variable because of changing fashions.

The interior decorator, contrary to general opinion, never deliberately attempts to create an "original" room. Instead, he applies his ability to solving the problems at hand, and the elements of the problem itself and his individuality of expression result in the ensuing originality. The talent required in aligning the various elements of a decorative problem into a flawless composition is what intrigues the decorator: the uncertainty of the outcome of an experimental color treatment, the way the room will appear at night in its lighting scheme, or the relationship of plain and patterned areas, proposed furniture arrangement, and necessary architectural changes when plans are still in the blueprint stage.

It is a simple enough matter to follow a given set of decorating rules in order to achieve a desired end, but a room assembled in such a manner marks the difference between mere "decorating" and true creative "designing," and the result is evidenced always by an effect that is just as certainly marked. It lacks individuality, for one thing, and there is consequently no personality. And nothing is drearier of aspect than rooms lacking in that "beautiful necessity," personality.

What, then, is the secret of conferring per-

sonality upon a room and giving it a vital, livable quality? The answer is simple: when an interior is not possessed of the spirit and enthusiasm of the decorator who created it, then that room lacks the vital quality and individuality recognizable at once as personality. And as every professional decorator knows, the surest method of acquiring personality—and charm—in a room is by means of style.

The Traditional Style.—Styles in interior decoration have always been influenced by those trends immediately preceding, and the decorator's main efforts therefore are devoted to interpreting them discriminately and to decorating interiors based on historical period connotation.

At the turn of the 20th century it was the custom to reproduce entire rooms in complete detail from some Italian villa or French château, but the decorator is now more concerned with the less identifying architectural aspects of a style in planning a room for present living. These are usually enhanced by furniture of traditional design, combined with contemporary items and fabrics woven in modern or traditional patterns.

The human body has always been the model to which furniture has been correctly scaled, and antique items that do not fall into this category are no more of good design than those made today which are not in good taste, nor will they be in correct proportion to the rooms in which they are placed.

Interior decoration in the traditional style, to be good, should be interpreted in a contemporary manner but with all the gracious and livable qualities of the old evident, being otherwise completely modern in convenient arrangements of

furniture and treatment of color scheme. Anyone with good taste and knowledge of the historical epochs in furnishings can re-create correctly an interior expressive of a defunct style. It may even possess grandeur, but unless its decoration expresses a 20th-century concept for living, it will be an anachronism. Moreover, sophisticated traditional interiors—for all their formal beauty of decoration—are not conducive to relaxed, comfortable modern living.

The Contemporary Style.—Modern decoration has resulted in an entirely new approach to decorative treatments with its precepts based on functionalism and a radically different conception of the decorative treatment of space. Certain social and psychological factors produced the conditions which developed it, and modern decoration

of doors and windows—conditions rarely found in present-day houses and apartments. This has resulted in the need for adapting the period styles—frequently with vexing results. If carried out correctly, as in the removal of moldings, etc., it entails a large expense for construction changes.

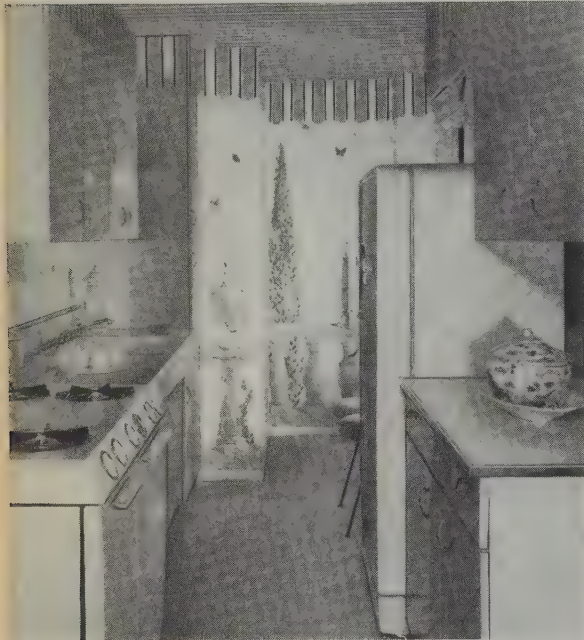
The owner of a house or apartment to be decorated in the modern manner has no such problems, inasmuch as the most obvious characteristic of contemporary styling is the result obtained by an avoidance of elaborate architectural details and moldings, and adherence to plain surfaces and straight lines. Conditions are generally accepted as found, and their proper development rests with creative ability and imagination and therefore offers interesting possibilities. Exposed beam ceilings, for example, are accepted as a part of the decorative scheme, as is asymmetry in plan and disposal of windows and doors, characteristics prevalent in contemporary architectural design.

Individuality in Decoration.—There is only one thing that will produce a successful room with individuality, and that is good taste backed by information in the subject of interior decoration. Individuality and adaptability to use have always been the most highly valued qualifications of a decorative scheme. A room that permits the expression of the owner's individuality will ever be a favorite. The average owner has a hobby, sometimes not well defined, in other cases most definite. To give expression to this hobby in the creating of background is the meaning of individuality in a most definite way.

The main factor inducing the various rooms in different houses and apartments to be unlike in the styling of their decoration can be attributed to either of two things: it may be money, or it may be taste. The interior decorator, in addition, resorts to individual design or period influences in any room which makes any pretense to distinction, and there is always this recognizable feature as the inevitable stamp. There should never be, however, any difference in the quality of the decoration between the budgeted room and a more elaborate one, the difference being in degree of elegance desired rather than in actual quality of decorative treatment.

With unlimited resources it is quite possible for anyone to create a beautiful room. But upon bringing the problem in decoration to the expert in home-furnishing, the client naturally expects competent guidance and the utmost value for the minimum sum to be expended. Good taste, besides being aesthetically satisfying, costs less in the long run than bad taste because it eliminates the elements of repeated alterations. The decorator may experience qualms of dismay and frustration over a budget at first, but in the end, because he possesses the knowledge of how to do it, he produces a satisfactory result which contributes comfort and beauty, at a saving, without sacrifice either of authenticity or good taste.

To create a successful interior also requires the ability to conceive of a complete interior picture, and not mere corners or groupings of furniture in the scheme. It involves a specialized study of traditional and modern styling with the information that makes it possible to assemble the details into a harmonious and pleasing unity. And with this ability to interpret detail it is essential to know the relative qualities of fabrics, upholstery work, curtains, furniture design, rug design and textures, wood and wall finishes, as



Small kitchen decorated by James H. Daggett, Jr., gains cheerfulness from colorful paper on ceiling and end wall. All furnishings are kept against walls, leaving free areas for kitchen activities.

became the popular style it is because the stage was set for it.

Whether one's choice is for the traditional or the contemporary style, the principles to be observed in decorating are the same for both. It is only in their application that they differ. Decoration in the contemporary, or modern, manner will evidence the same fine proportions and simple lines characterizing that of the traditional style with its period connotations. Modern furniture, as well as fabrics, floor coverings, and accessories will harmonize with their modern background. Interesting interiors can result by mixing traditional with contemporary design, and a modern room may well have a traditional item or two mixed in successfully, just as a traditional scheme gains by the addition of a modern background or an item or two with modern lines, and the use of modern fabrics and other materials.

Traditional decoration requires symmetry in wall treatments, flat ceilings and the axial spacing



T. Merrill Prentice Jr.

INTERIOR DECORATION THROUGH THE AGES

Principles of good design outlive changing fashions in interior decoration. Designed around 1600, the room at left is from the teahouse of the Katsura Imperial Villa in Kyoto, Japan. The dining room below represents mid-20th century American design. Despite the differences in the periods and places in which they were built, both rooms embody similar ideas of restraint and proportion. Textures of wood and fiber contrast with oiled paper in the Japanese room, with marble in the American room.

Designed by Elaine Lustig/photograph by Louis Reens



THE AGE OF OAK

The treatment of wood became increasingly ornamental during the Renaissance, a trend exemplified by these French and English rooms. The room at right, from the château at Azay-le-Rideau (about 1520), Touraine, France, has a stone mantel and beamed ceiling. The wood paneling and pargeted ceiling of the Long Room in Haddon Hall, in Derbyshire, below, is in characteristic English Tudor style. The French Renaissance in full flower produced the ornate Louis XIII style seen in the grand salon, opposite.



French Embassy Press & Information Division

Louis H. Frohman





Life Magazine

Château de Cheverny, in Touraine, France, dates from around 1634.

NEOCLASSICAL INTERIORS OF THE 18TH CENTURY

Showing the influence of classical Greece and Rome, 18th century designers used restrained decoration and fine-scaled architectural detail. The interior at right is the salon of the château at Fontainebleau, France, in Louis XVI style, with Empire furniture. A neoclassical design inspired by Robert Adam is seen in the room below.



Louis H. Frohman





Keystone Press Agency, Ltd.

The dining room at Luton Hoo, Bedfordshire, in England, includes furnishings in the Régence style of early 18th century France. French Beauvais tapestries line the walls.



Norman McGrath

The Wedgwood Room of Dublin Castle (around 1790), Dublin, Ireland.

AMERICAN INTERIORS



Life Magazine

In the colonial period, kitchen, living room, and dining room were often combined, as in the 18th century interior above. Later American interiors drew heavily on English styles. The White House library, right, is in English Regency style, and the living room, below, in English Georgian style. The "Chinese taste" of the 18th century is expressed in the painted wallpaper in the Maryland parlor, below.



White House Historical Association

Winterthur Museum, courtesy of American Heritage





Brooklyn Museum, courtesy of American Heritage

Victorian parlor (about 1870), from a home in Saratoga, N.Y.

CONTEMPORARY INTERIORS

Modern living room in the home of architect Serge Chermayeff has a built-in sofa and early modern furniture of the 1930's. Traditional and modern furniture are combined in the contemporary living room below.



Designed by Serge Chermayeff/photo by Norman McGrath

William Pahlmann, F.A.I.D.



well as being familiar with an infinite number of new products applicable to interior use.

Out of the decorative materials available—the fabrics, floor coverings, wallpapers, furniture, and accessories—the interior decorator creates a new room or changes the aspect of an old one into an interior entirely of his own inspiration, expressive of his own time and temperament, worked out in the decorative mediums available as he visualizes them to be in the completed interior.

To create attractive and correctly-planned surroundings does not mean that the decorator must resort to a monumental scale in the decoration, which is solely architectural, and pertains to the proportions and the formal decorative treatment associated with marble or inlaid polished wood floors, elaborately treated walls and ceilings in the interiors of great houses and palaces. The basic principles of good design are the same, however, whether used in formal decoration, monumental in scale, or informal, simple schemes of decoration. It is only in their application that they differ.

The decorative treatment of any interior is, after all, an expression of the personality of its owner, and it should form a suitable background for the family's everyday way of living. But since there is great diversity of individuals and their tastes, there can be no fixed rules nor can beauty be confined to any particular style. The result in every case expresses more or less complexity of motive, and upon this largely depends the charm of the room if its reason for existing is to be coherent. The two things above all others needed to secure coherence and clearness of expression are: good composition in furniture arrangement (the result of good planning) and expert disposal of the color scheme and of the accessories.

Selecting a Decorative Theme.—Once the family's pattern of living is established, the next step in order to create a proper background is for the decorator to decide upon the decorative theme as a means of conferring personality and helping in creating the proper atmosphere. Deciding upon the decorative theme will depend upon whether Early American and a Cape Cod type of house is desired, for example, or whether the preference is toward ornate Chippendale and a Georgian house, vigorous Sheraton and a Regency house, or the contemporary style and a modern house.

For no interior can be slap-dash in its decorative treatment and be satisfactory. It demands careful consideration of architectural background, furnishings and accessories. Just as every successfully planned and decorated room must have a focal center—a radiating center of interest for its entire scheme—so does it depend upon its accessories to distribute this interest, in turn, about the room. It is through the dissemination of a single idea, or theme, in its decoration that the successful room differs from the poorly decorated one and reveals itself as an organic entity.

Once a theme of decoration is established, the next step is to consider the functions of the respective rooms and to allot each a share in the estimate of costs, depending upon its relative importance in the family's pattern of living.

The proper approach to any scheme of decoration is a resolve to develop rooms of individuality without recourse to any others of similar type. If this precept is observed, interiors will result in neither a traditional style nor the transient vogues of the present.

Begin with a Plan.—Planning is the first step to successful decoration. And organization is the method by which the plan is brought to completion. One patterns the plan around the living habits of the family. If the plan is a good one, there will be no continuous redecorating and moving furniture about, only an occasional re-furbishing. Any object which does not fit into the plan, no matter how much it may be esteemed for sentimental reasons, should be ruthlessly discarded.

With the planning the decorator includes a preliminary investigation of any existing decoration, considers any favorable architectural elements, and, even before making an estimate of costs, ascertains what new furniture, draperies, wall covering, and rugs are needed. Architectural



Top: By Tommi Parzinger; bottom: by C. Eugene Stephenson

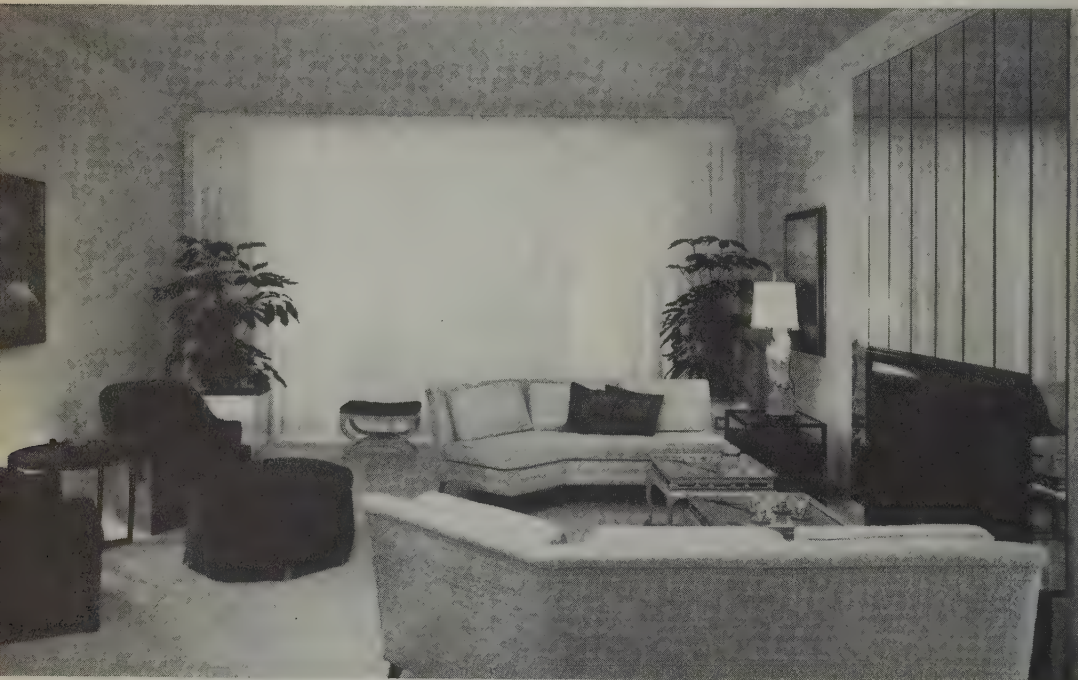
Above: A small living room appears larger by keeping furniture to a minimum and by flanking fireplace with identical groupings. **Below:** Low furniture arranged in strong horizontal lines makes ceiling appear lower.

changes, if any, are carefully studied and door and window openings, as well as old lighting fixtures and woodwork, considered for possible re-

placement. An estimate of costs would also include any new furnishings, repainting and re-finishing and reupholstering of furniture not discarded. And new floor coverings, draperies and bedding will contribute much toward making any old bedroom assume an attractive appearance.

Backgrounds.—Walls have to be ornamented if they are to assume their chief purpose as a decorative background, and usually they form the basis for an entire scheme. Color and texture

papers (see WALL COVERINGS) will always remain deserved favorites because they are often-times peculiarly appropriate in small interiors to give an effect of increased space, or to supply stimulating decorative interest in incidental rooms such as guestroom, dining room, or bathroom. Iconoclastic practice pervades the modern use of patterned wall coverings, and the old rule of small rooms requiring small designs, because the reiteration of pattern is less conspicuous, no



A formal living room in contemporary style acquires a sophisticated air by contrasting sharp color in few furnishings against an off-white background. Furniture was designed by David Wider.

are all that are required to give walls life and interest, but pattern will be needed to contribute additional character.

Because of the importance that walls assume in decoration, they have to be treated as background for the furnishings or as pure decoration in themselves. The competent decorator is never at a loss in combining these two essential factors, if necessary, to produce flawless rooms indicative of the owner's taste and interests; he carefully weighs the degree of ornament and color value in walls against the respective decoration in the other surfaces and produces a total effect that is decorative yet never insistent.

A poorly proportioned lamp, an awkward bowl, or similar accessories that are wrong in color can be ignored, but the things that go on the wall—that are part of the background—are hard to overlook if they are shriekingly bad. And it is better to have none at all than to have these. There is great diversity in the accessories that belong on the wall: ranging from fine floral panels to individual pictures, and including fabrics, any of which can be counted upon to add pattern as well as color; and there are paintings on canvas, wood, or glass.

Patterned backgrounds in the guise of wall-

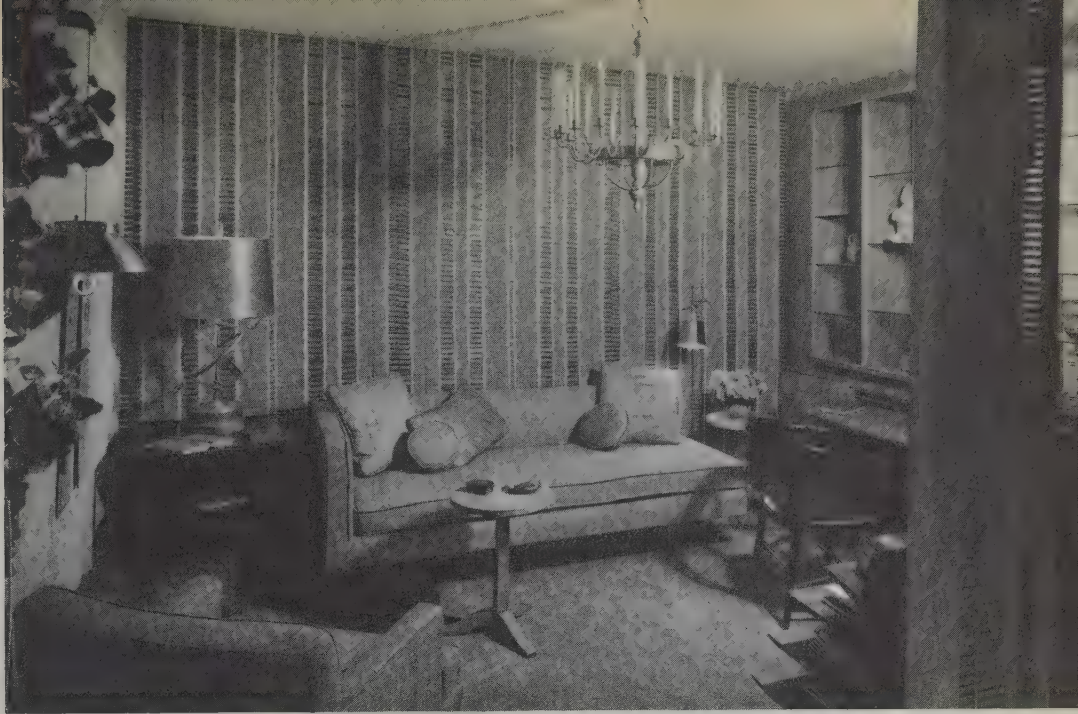
paper holds; for, surprisingly, a giant pattern is frequently the only refuge in certain situations such as a long narrow hall studded with door openings and containing no furniture.

Decorative wall coverings—paint, wallpaper, grasscloth, etc.—are generally used either to coalesce the color schemes of the various rooms into a harmonious whole with one room opening naturally into another, or to permit greater variety in the individual color scheme of each room.

The decorator is motivated in a choice of backgrounds by two considerations: Is the room to be pretentious in scheme or simple? Is it to be stimulating or reposeful in character? Regardless of the decorative treatment, another consideration is suitability in purpose, color, pattern, and scale. A factor in selecting a wall covering is whether it will blend with the woodwork, furniture, and draperies once it is on the wall. Designs that obtrude into the room or indicate any movement in pattern should be ignored.

Wall treatments can best be determined by one or the other of two methods: derive the color scheme from the colors in the design of the wall covering itself; or decide first upon the color scheme and fit the wall covering to it.

Another determining factor in any considera-



Ruth Sherman, Dunbar Furniture Corp.

In a city apartment, furnishings of simple design are given a pleasing background by a yarn and bamboo roller blind.

tion of the decorative background is the floor. In addition to wood, of which there are several different types, including patterned parquetry, or parquet, the more popular floorings include linoleum, stone, brick, rubber, cork, asphalt, tile, and those made of vinyl products. A floor of any one of these materials can be developed in a design appropriate to any scheme, either as a dominant decorative element or as a background for the rug.

A wall-to-wall carpet, or room-size rug, will make a small room appear larger; and it will also help to unify an irregularly shaped room. Or an area rug can be used as an island for the main grouping of seating furniture in the room, and the rest of the floor left bare, waxed, and polished. For the inexpensive house, there is the woven fiber rug in various textures, weaves, and patterns. For the formal living room or dining room, a shiny vinyl, rubber, or linoleum tile floor with inlaid design of brass strips is recommended.

Contrast is usually the key that makes decorative schemes interesting, whether it is in a mixture of light, medium and dark colors, the hard and soft textures of fabrics, round and oblong shapes of furniture, or high and low eye-levels of accessories and draperies. The factor of contrast is particularly important in developing color harmony.

Color Harmony.—If furniture is the contributing factor of character in an interior, then color, more than anything else, gives a room its personality. And of all the manifold problems of decoration there is none so vital, nor one which evidences so surely a comprehension of the subject, as a deft handling of color.

Yet the correct use of color in decoration can be quite simple, although the very success of every

interior depends upon it, regardless of the style and quality of furnishings used. Indeed with color alone a room may have its architectural features emphasized, or minimized; it can be made to appear larger or smaller, higher or lower; it can be made brighter or darker, warmer or cooler.

A room without window walls and a view need not stress the lack by an atmosphere of confinement. With a flowering print of linen or cotton used with a free hand throughout a room, an effect of a garden can be suggested that will contribute such freshness and beauty that the view will not be missed.

An interesting color treatment can be realized by selecting favorite colors—blue, yellow-green, and lavender, for example—and tying them together with chalk white. White, in this instance, unifies the color scheme, and, like the use of a little black, gives the scheme balance.

Two other new color schemes, featuring brilliant colors against a monochromatic background, include electric blue and silver fabrics, combined with bone-white walls and dark furniture; or a brilliant pink or turquoise background accented with black and white.

Still another novel idea would be to paint the ceiling a strong bright color and, by means of reflected light, tone the entire room.

The development of any color scheme is predicated upon an acquaintance with the vivid *primary* colors, red, blue and yellow; the *secondary* colors, green (yellow mixed with blue), orange (yellow mixed with red), and purple (blue mixed with red); the *complementary*, or contrasting, colors including red with green, yellow with purple, and blue with orange; and the variable *tints* (produced by the addition of white) and *shades* (produced by the addition of black). A tertiary color,



Georgian room, Newland, Gloucestershire, England. The house was built in 1748.

Courtesy Museum of Fine Arts, Boston

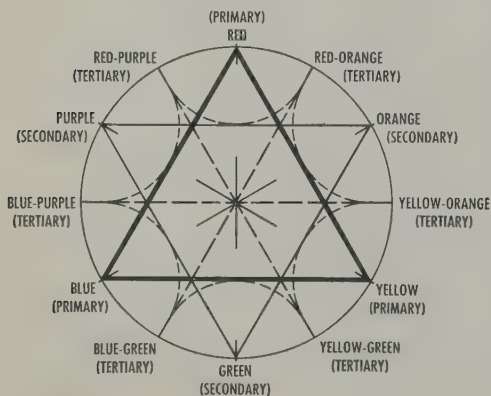
of which there are six, is the combination of a secondary color with a primary color. A *muted* color is obtained by mixing both black and white to any color, tint or shade.

The simplest way to develop a color scheme is to select a color in the rug or curtain fabric (if patterned) and assemble other colors in the room around it. The color selected will be the *basic* color. Used in such manner, either a *harmonious*

or a *contrasting* scheme will result, depending upon the colors assembled with the basic color. The colors in a room keyed to a single hue, such as crimson with rose and pink, results in a *monochromatic* color scheme. A *related* color scheme results from combining a single hue with related colors, as red with purple and blue, or purple with lilac and blue. For effectiveness, the number of major colors in a scheme should be limited to two or three, so that their *contrast* value is emphasized, and the effect can be spiced by the addition of a small quantity of related color. These *accenting* colors, either contrasting or harmonizing, are necessary in preventing the scheme from being flat and uninteresting. Too many accenting colors, however, may cause confusion in the decorative scheme.

Color should never overwhelm. A background color should be restful enough for leisure, yet stimulating enough for work. Unity can be achieved without monotony by varying the tones and textures of the furnishings which reflect light in different ways. Light, bright colors such as pink and yellow, or green and blue, suggest a gay, friendly atmosphere.

Formerly the cool colors, such as blue and gray, were not recommended for rooms with a northern exposure; a better selection being the warm colors, such as red or orange. Nor were





An "outdoor" atmosphere is given a living-dining room decorated by Elizabeth Banning, A.I.D. Furniture includes dining table used for games and a corner grouping for conversation and television.

warm colors used in rooms with a southern exposure; here a better selection being the cool colors. But air conditioning has made the interior decorator independent in his choice, so that colors now are used as desired with no consideration of room exposure.

Cool colors have the effect of increasing the size of a room, just as warm colors tend to diminish it. Similarly, dark colors tend to make rooms appear small and crowded, and light colors give them an atmosphere of spaciousness. Nevertheless beautiful rooms of rather formal aspect can be planned around black, white, and gray when either used alone or combined with other colors. Walls and woodwork painted the same color tend to make rooms seem larger. An effect of increased spaciousness can also be obtained by painting connecting rooms the same color, so that they appear to flow together. And too-high ceilings can be made to appear lower by being painted a darker color than the walls. A too-wide room can be made to seem narrower by painting the side walls darker than the end walls; and the room can be made to appear wider by reversing the process.

Background colors should be definite and fresh, in such clear light hues as lilac, pink, saffron, yellow, blue, and green, never of an indeterminate dark hue. The ceiling should be included in the background, and may be the same

color as the walls, or painted a contrasting color, preferably the same light or dark value. If the floor is wood, it should be stained dark walnut—never left in a light finish lest it not stay "down"—then waxed and polished.

Improper illumination can "spoil" any color scheme at night, regardless of how attractive it may be in daylight, therefore time spent in planning adequate lighting—including the distribution of lamps in the room for the best effect—will prove very rewarding for the decorator.

Furniture Arrangement.—It is a mistaken notion to think that one must have the benefit of spaciousness and the advantage of vistas in order to build rooms faultless in design qualities, efficient in furniture arrangement and beautiful in effectiveness. Particularly since these prime requisites are lacking in small houses and apartments. The procedure therefore is one of overcoming limitations in order to produce a pleasing effect. And the best means of doing this is through a consideration of the room's arrangement of furnishings.

Any interior worth assembling will present technical difficulties for the decorator, since every room has certain fixed requirements for family activities requiring specific items of furniture. From these activities groupings of furniture begin and the particular arrangement in the room is the natural result. Traditional furniture follows,

usually, a set pattern that seldom deviates, whereas in modern design variability is the rule, with furniture arrangement adapted to living habits. Naturally there is no basic design application.

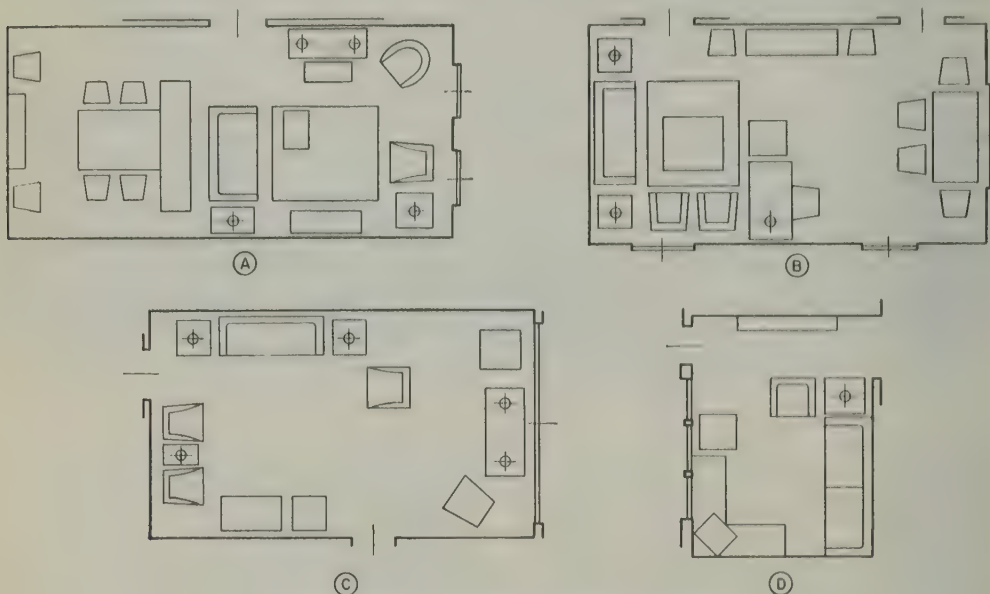
The importance of the fireplace in either a traditional or contemporary room cannot be over-emphasized. The mantel, if there is one, should be in proportion to the room and not made merely to fit the fireplace opening. (The size of the opening is in direct ratio to the size of the flue: the smaller the flue, the less cost, hence the majority of fireplaces are too small for the size of the room. The difficulty can be overcome by adding facings of marble or stone.) The proportions of the mantel to the size of the room varies with the styles of period decoration: the Colonial style is characterized by big mantels in small rooms; the French styles, by contrast, have small mantels in large rooms; the English styles strike a happy medium, with mantels neither too large nor too small for the rooms in which they are installed.

ture within the areas allotted for various activities, being careful not to allow one group to interfere with another. This plan leaves the center of the floor clear, and the room gains in spaciousness. Disregard corners, and add pictures, sofa pillows, and other accessories at the last moment, reducing them to the absolute minimum in order to keep from crowding the effect. (See Floor Plan C.)

The problem of a long, narrow room can often be solved by altering the proportions. This is accomplished by dividing the long room into two separate groupings without sacrificing its unity and composition. (See Floor Plan A.)

The dining room, because it is occupied only during infrequent intervals of the day, offers an opportunity for a more dramatic decorative treatment than do the more lived-in rooms.

Finally, when planning the furniture arrangement of a room, fulfill all immediate requirements, but allow for future expansion. Such a plan is called the total design approach, because all immediate requirements are combined with any



Suggested furniture arrangements for one-room apartments.

Start with a floor plan of the room, drawn to scale, with all its undesirable features—such as doors opening into the room, windows too close together, radiators, etc.—indicated. Next, take advantage of the room's best feature—usually a window with a view, a fireplace, or a wide wall space where an important item such as a break-front desk or a television cabinet will be set—and add a sofa, coffee table, and chairs with accompanying tables for lamps, being certain to keep all traffic lanes clear; to this center of interest, add such secondary groupings for furniture as a table and chairs for games, or a television set that can be seen from every angle of the room. Large furniture items, such as a piano, breakfront desk, or sofa, should be kept parallel with the walls, and never catercornered, with a grouping of chairs and accompanying tables centered around each to form an interesting composition. (See Floor Plan B.)

Avoid crowding the plan, and arrange furni-

ture within the areas allotted for various activities, being careful not to allow one group to interfere with another.

Acquiring the more expensive items gradually over an extended length of time, and supplementing them with the cheaper furnishings, is recommended where there are budget limitations.

Budget Limitations.—The decorator should be aware of the value of furnishings as an investment, but at the same time expect returns from them in terms of durability, beauty and enjoyment.

Where restricted living space and limited funds force the newly-married couple, the bachelor, or career-bent girl each into the one-room apartment, the functions and purposes of furniture have to be combined. All one-room apartments can be divided into three parts: storage, dining, and living areas. (See Floor Plan D.) But far from being conducive to the state of confusion, one-room living can be very satisfactory from every point of view: a sofa by day becomes a bed at night; a chest of drawers is used to store linen

or as a sideboard; a table is used for games, for studying, and for dining. In this way space is conserved, making more activities possible in a specific area. In the same way, a guestroom that combines a living room with the comforts of a bedroom represents the ultimate in hospitality.

The first step in assembling a room for one-room living is substituting for the bed a couch with throw and pillows, or sofa-bed; otherwise the room will not be convincing. Accent pillows in harmonizing fabrics complete the room for day-and-night use. And there need be no sacrifice of either beauty or good taste for an attractive result. Instead of mahogany or walnut furniture in expensive finishes, natural woods such as birch, pine, or maple are selected; a harmonizing color scheme is enlivened with growing plants, and accessories are kept to a minimum, being limited to a few purposeful things such as a large mirror and attractive lamps. For the deadly foe of one-room living is senseless clutter. The color scheme will be a bright one, but it will be kept simple: green and white, pink and yellow, or lilac and blue, being a few combinations that are smart without any price connotation.

Whether the small house or apartment developed within budget limitations is contemporary in style, or follows a precedent of traditional design, is a matter of personal preference. New products offer an endless variety of home furnishings with which to create decorative schemes never possible heretofore except in expensive furnishings. There are, for example, inexpensive fabrics distinguished by textures and patterns applicable in either traditional or contemporary ensembles, and imitation leathers and modern plastics, resembling fine woods and marbles, which can be used for table tops, as well as paneling.

The folly of attempting to decorate a room—any room—without a plan of expenditure will be made more and more evident in each step of its development. The decorator should first compile a list of expenditures which provides only for the necessities absolutely fundamental to the development of the decorative scheme; but a supplementary list should also be made to accommodate any alternatives which may be used in the scheme as it progresses, as well as any additions to be made later if the budget is expanded.

In efforts to achieve charm inexpensively, interior decorators are more and more employing the painted background as an effective foil for lovely furniture and color schemes. They know from experience that decoration in its best phase is not dependent upon embellishment. And inasmuch as simplicity is the main characteristic of the contemporary style, it is the favorite resort in creating budget rooms. Another reason for the contemporary style in budget decoration is that it combines so easily and dramatically with traditional items, old furniture being especially effective with decorative objects and backgrounds in the modern manner.

In seeking individuality for the interior, the decorator should not be timorous either in his budget or decorative plan even though it may be for a budget room, for the resultant charm may depend upon maintaining a certain balance throughout for a particular effect. Strive for spontaneity and originality. Certainly price is the last thing a budget room is to suggest.

If the budget permits but a small outlay, it should be distributed proportionately so that money is spent where it will insure the most

value, as in the furniture or the floor covering. Unless an eye is kept on the budget, however, there may be a tendency here to overspend on a single expensive item—such as a rug or sofa—leaving only a small balance remaining for expenditures. Therefore where there is a limited amount allotted for a room, it is better to buy all items in proportion to the total budget.

Although wall finishes are expensive and difficult to change frequently, do not eliminate structural changes from the limited budget without first giving them deliberate consideration. Usually they supply so much architectural interest that, in the room being decorated for permanence, more expensive items such as imposing cabinet furniture can be eliminated for later incorporation.

There are occasions when fine woodwork, doors, mantels, and other details give a definite architectural character to a room and dictate expensive, permanent furnishings, but in rooms with no tendencies to any particular period, it is sometimes a matter of expediency in saving money to establish style interest by substituting inexpensive, relatively impermanent materials and finishes for more expensive ones. Thus standardized moldings and trim can be substituted for expensive handcarved woodwork; wallpaper, plywood paneling, or wood veneer on a paper backing, for expensive wood paneling; marbled and quilted effects printed on wallpaper can substitute for the genuine materials; embossed wallboard, sheet tiling, and enameled brick in tile patterns, for tile and mosaic; and linoleum, vinyl, or rubber tile, or asphalt composition flooring for marble.

Likewise where large items of furniture may be out of scale with their background, even in the pretentious interior, simpler and smaller pieces in natural finish, painted and decorated, may be substituted with pleasing results.

Slipcovers can transform old upholstered furniture by concealing its defects and adding fresh pattern and color, and they can also save one quite a sum of money when used on new muslin-covered furniture as a substitute for expensive permanent upholstery covering.

Lighting the Home.—In any decorative scheme the first consideration is the assurance of ample light: windows by day, and lamps by night. The light in a room is therefore an all-important part of the scheme, whether during the day or night, where it must be useful, yet decorative. In planning the room's illumination, the first thing to consider is the light sources, consisting of the lamps and lighting fixtures that are used.

These light sources should be as much a part of the scheme as are the draperies, furniture and rugs. In traditional rooms they should be related in style, decorative treatment and general composition to the rest of the furnishings. Authentically-designed period lighting fixtures and lamps (see LAMP) are available in the market, and antiques can be superbly adapted to electricity. In the contemporary room the fluorescent tubular lamp, installed behind window draperies and cornices, as well as concealed "down-light" fixtures in the ceiling, mean great adaptability in architectural lighting resulting in rooms notable for their decorative charm. Indeed with an acquaintance of the simple characteristics of light, and creative imagination, any room can be made a lovely place. For example, since mellowness is the chief quality desired in lighting, wax candles combined with



Enclosed porch decorated by Neiman-Marcus is given individual treatment in contemporary style, with painted brick floor, specially designed furniture, and contrasting color in casement curtains, upholstery and painted shingle wall.

electricity constitutes the ideal form of illumination for dining; shaded side lights will give a diffused light to the room and unshaded flames of tall candles on the table above eye level will contribute a festive glow that is most desirable.

Windows.—Windows are sources of light in the room and should be treated accordingly for maximum efficiency. Therefore drapery treatments should be kept as simple as possible. Windows are also the room's most important single decorative feature, because they can mar its friendly aspect or be depended upon to give an appearance of cheer and welcome. Because so much importance is attached to windows, too much attention cannot be devoted to their decorative treatment.

Windows are a special problem because, whether they are treated as an integral part of the scheme or simply as a part of the background, they are generally too high, too low, too narrow, unevenly balanced on a wall space, or are associated with radiators and air-conditioner units that protrude beyond them.

The low window can be given an appearance of greater height by merely hanging the draperies and curtains to the floor; or the draperies can be hung above the window frame and the space between the top of the window and the rod covered with a valance or cornice. The narrow window can be made to appear wider by hanging the draperies a few inches out on the wall at

both sides and covering the top of the curtains with a valance or cornice. If the window is unevenly balanced on the wall, draping the entire window wall from ceiling to floor and wall to wall will give the wall a semblance of architectural balance.

Corner windows are treated in the same manner as the low window: that is, framed with a simple cornice and with draperies hung at the sides; the window space, in every case, can be filled in with either sheer curtains or blinds. The bay window is usually a special problem that can be best treated with a valance connecting draperies at either side of the outer windows, and Venetian blinds or sheer curtains filled in underneath. An equally pleasing, but more architectural, effect can be gained by filling in the window areas with two tiers of louvered shutters or café curtains.

Clerestory windows in contemporary houses, as well as small high windows flanking a fireplace in old-fashioned houses, are always simply curtained with a sheer fabric or louvered blinds, without draperies, making them blend as much as possible with the walls. If radiators cannot be moved to some other place in the room or concealed with built-in covers, or if there is an air-conditioner in the window opening, the usual solution to the problem is to hang café curtains on the trim, halfway up the window, and allow them to hang straight to the floor, concealing the

radiator and air-conditioner unit; then upper panels of café curtains are added, or draperies are hung over the trim in the customary manner to the floor, over the first café curtains.

Draperies refer to the heavier fabric hung over the window frame, usually to the floor, and generally with a neutral color sateen lining. The curtains, to assure privacy and temper the light, are usually of a sheer material hung under the draperies, or in place of the draperies, and include such fabrics as casement cloth, organdy, net, dotted swiss, marquisette, thin muslin, or silk gauze.

Windows with draperies, plain or patterned, are more suitable for formal rooms, either traditional or contemporary in style, while ruffled or tiered curtains, used alone, are best used in simple rooms of provincial character.

A consideration too often given little thought is the matter of window shades in their relation to the street and to the exterior of the house. The interior naturally should dictate the choice of shades, but the face of the house should be borne in mind at the same time and shades chosen that will harmonize with both exterior and interior. Blinds include Venetian blinds, bamboo and matchstick blinds, as well as louvered shutters, and are best considered as part of the background of the room, and painted a neutral color blending with walls or curtains. Roller shades can be of textured fabric, to give them a new look, or they can gain in decorative value by being made of fabric to match the draperies. Roller shades, if made of patterned chintz, can be a distinctive decorative feature when they are combined with crisp ruffled sheer curtains—and no draperies are then needed.

Kitchens.—Although a kitchen is primarily a workroom, it need not be coldly efficient. And it is a myth that color is not appropriate in the kitchen, because examples in strong color contrasts—such as yellow with bright green and splashes of red on tables and chair seats—have resulted in the kitchen being the most attractive room in the house. Enameled equipment and washable wall surfaces have a high reflective power which increases the brilliance of any color. Color in the kitchen is an even more important factor in its decorations if the family eats there. Pictures on the walls, and fruits and vegetables in still life compositions are fresh ideas for kitchen decoration.

Each fundamental part of equipment in the kitchen must be assembled in an organized manner. Arranging the compact units that are on the market is, of course, regulated according to the size of the room in which they are used, which in turn depends on the number of members in the household. Sufficient space is available, it will seem, only when starting from the blueprint; but in remodeling it can readily be achieved by centering units or changing doorways and partitions to produce a workable area combined with good design. Working tops of laminated plastic material, on low cupboards and tables, are burn, stain and scratch-proof and can quickly be cleaned by wiping with a damp cloth. Standard sizes are available in storage equipment, but those units that are made to measure give the decorator greater scope in attaining balance or in expediting the arrangement according to the conditions present.

Porches and Terraces.—Porches, including breezeways, terraces, and patios, are considered

an extension of the house, and as such have a decorative relationship with it, the only difference being that the outdoor room receives a less formal treatment than the indoor living room.

For the terrace or porch an appearance of spaciousness is desirable, because nothing is more enervating than a crowded effect outdoors of a warm day. Furniture groupings are distributed around the walls and never in the center, and passages to the living room and to the garden are never obstructed by chairs or tables.

Furniture on the porch or terrace receives the same consideration for convenience and adaptability to comfort that it would indoors: a table with an umbrella, and a pair of chairs at the far end of the terrace, a glider swing and several occasional chairs; a table and chairs for cards; a covered chaise-longue on wheels; a table beside a chair for a book and refreshments. Sturdy, weatherproof reed and rattan furniture is smart in appearance and serviceable, and can be fitted with waterproof cushions; metal furniture that can be easily moved about is especially good when combined with reed or rattan items. For the rustic setting, the furniture made of hickory, either peeled or with the bark left on, is ideal.

For the outdoors a color scheme should be decided upon that is bright and clear, one which will make the terrace appear cool and livable during the warm months. White combined with yellow, green, blue, red, or brown constitutes a highly satisfactory color duet to enliven the scene and repeat the colors of the garden. Awnings may accentuate these hues in stripes or in solid colors.

Sculpture, the most permanent feature in decoration for the garden, terrace or porch, may assume decorative figures, fountains, architectural elements or such usual forms as vases and urns for interest. Because of its importance in the scheme, sculpture should be carefully selected and placed in strategic spots.

The Child's Room.—Because the child's room must keep pace with a growing youngster, developing along with him, it is probably the only room in the house that goes through several metamorphoses. Therefore buying furniture with an eye to the future is the most sensible plan. The functional contemporary ensembles of cribs, chests and chairs can be used as the child grows older. And manufacturers offer cribs that can later be transformed into beds, and chests which can be fitted together to make cabinets and desks to fit the needs of the older child. A bassinet on wheels is ideal for the baby; whether it will be all flounces and frills or merely plain and practical depends upon the budget. Period furniture is appropriately used in the child's room provided some forethought is given to the selection. For example, a small desk or chest in a period style can be the beginning for the older child's group of furniture. It should be remembered that all the furniture is for the child's use and should be scaled and designed proportionately. A high chest of drawers, the top of which the child can scarcely see, let alone reach, is likely to be bewildering. Chairs, mirrors, and chests should be usable and not make the child feel dwarfed. Washable wallpaper or one of the synthetic wall coverings will not only satisfy the practical side, but be decorative as well. Linoleum, in appropriate colors and patterns, is always good as a flooring in a child's room; if a rug must be used, a washable throw rug over it will complete the

scheme. Accessories deserve special consideration, and if they are hazardous they have no place in the room. If furnishings are wisely chosen in the early years, little will have to be discarded when the teen age arrives.

Finishing Touches.—Smart accessories complete the decorative effect in every room. If the effect desired is one of elegance—and elegance is the note most evident in many apartments and suburban homes—it is important to choose accessories consistent with the theme of elegance established by the other furnishings in the room. Perhaps what will be needed will be examples of exquisite porcelain, a decorative wall panel painted in oils, or an unusual flower arrangement to give the final note. In the informal room, or one without a “decorated” look—such as an early American, Provincial or a small-house type of interior—the accessories will be of simple character and more familiar forms, including hand-thrown pottery bowls and vases, handblown glass and decorated wooden boxes. Choosing these accessories and placing them correctly is the last important phase of interior decoration.

2. CONTRACT INTERIOR DECORATING

The contract interior decorator must not only be a qualified residential interior decorator, but he must be thoroughly acquainted with hotel and institutional operation—including schools, hospitals and banks—as well; he must also be aware of the special requirements for stores, transportation, offices and theaters. His attitude and approach to each problem is therefore different, because he has to cater to a wide cross-section of people, which may include the traveling public, the shopping public and the theater-going public. Individual whims have to give way to the satisfying of mass tastes. Yet it is still the duty of the contract interior decorator to hold the restraining hand in matters of style and good taste.

Stores.—The significance of decoration as a powerful stimulus to sales grows apace with merchandising, a fact evident in the strides which have been made in both the wholesale and retail fields during the past decade as store owners have come to realize that their clients prefer shopping in an attractive, pleasant atmosphere.

The decoration of a store or house is governed by the same basic principles. Reducing these basic principles to their simplest terms, it can be said that the interior of a house serves, first, as a background for gracious living, and second, as a mechanism for one's living. This means that as a background, color, type of fabrics, furniture, floor coverings, lamps and their arrangement, draperies, and other decorative factors are employed to create a visual effect. As a mechanism for gracious living, the design and disposition of the furniture, lighting, textures of fabrics and all the other elements which make up a room, are the main considerations. The store interior can also be considered in the same manner; it is primarily a mechanism for storing and displaying merchandise and, secondly, a background or stage for sales. For selling, the requirements include units for storing merchandise for sale, making it easy to be seen and examined by salespeople and customers with little difficulty, and including such items as shelving, bins, cases, drawers, racks, tables, counters, and chairs suited to the various types of merchandise. When the problem is one of modernizing an old building, the interior decorator begins an intensive program of com-

pletely reorganizing the various sales departments, including their architectural backgrounds and color schemes, as well as furnishings. Dramatic effects are achieved by various original devices of design, lighting and use of decorative materials. Before beginning the design of a new store interior, the decorator must be thoroughly familiar with the type of merchandise to be sold. In the volume-type of store the merchandise must be stored so that it can easily be seen and examined by the customer and the clerk; in the more exclusive shop, there is a tendency to keep merchandise out of view, the clerk bringing out the various articles for the inspection of the purchaser. The decorator also studies the individual merchandise, and designs cases and cabinets according to the requirements of each. Counters and tables are also designed to suit their own particular function; not only should the cases be designed to be decorative, but the merchandise itself should be so arranged that it forms a pleasing ensemble. An interesting arrangement can make drab merchandise, even shoeboxes, take its place in the decorative scheme. If the principles for merchandising are thoughtfully worked out, the decorator will find that the problem is not only to take the counters and racks and design them as individual units, but to create a background for them so that the entire store becomes a stage for selling. This means that the merchandise must be dramatized by the use of decorative materials, color and lighting. For, aside from its advertising value, an interesting and exciting store interior results in additional sales.

Offices.—If the office is to be workable it first must be made livable. When one realizes that the average businessman spends a third of his life in his office, it becomes clearly evident how essential this quality of livableness really is. The office must also acquire personality. This depends upon its livability; and if this quality is attained, there will be realized a fine air of dignity and comfort. After the functions of the various departments of a business have been studied in the preliminary plan, and a relative share of space allotted to each, the logical solution to the problem of selecting furnishings can then be determined. The first essential step here will be to ascertain the type of interior decoration that is desired, and whether it reflects the nature and personality of the business. The average office is concerned with today's business, and therefore requires nothing traditional in the manner of its decorative treatment; however, the personal taste of the owner may demand an office developed in one of the historical styles. When one realizes how very different one office can look from another, and that the difference is attributable entirely to the styling of its decorative treatment, then it is evident how important style is in designing offices. Decorating an office includes the selecting and placing of furnishings, but, more important, the designing and installing of architectural backgrounds in sympathetic relation to the types of furniture and the needs and personality of the business as well. Therefore the efficiency in functioning of the office will be an important consideration. Individuality in offices may be attained in various unusual ways by means of such materials as metals, wallpaper resembling paneling, cork, paint, leather, linoleum, glass, vinyl tiles, glass or plastic fabrics used on the walls. The windows may have Venetian blinds or vertical fabric louvers instead of cur-

INTERIOR DECORATION—2. Contract Interior Decorating



Above: In this hotel lobby by Otto Zenke, an air of intimacy emerges from the placing of furniture around the fireplace.

Right: An unusual staircase design adds a dramatic overtone to this spacious department store.

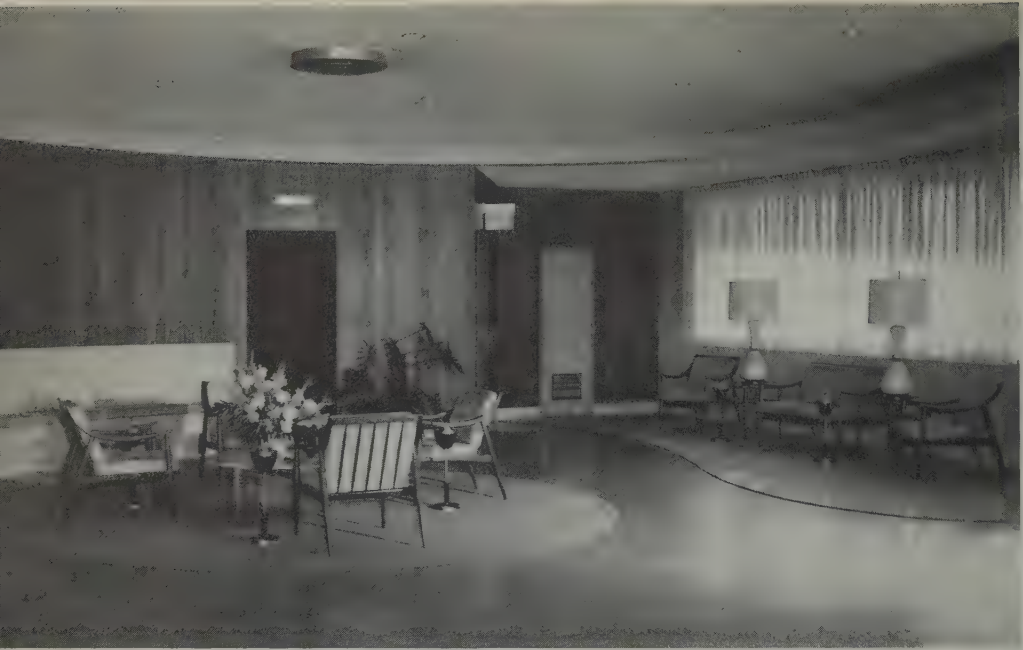
(Right) Ben Schnall; (below) Fehr and Granger



Below: An effect of warmth is achieved in this elementary school classroom through the use of varied surface textures, patterned draperies and interesting objects.



INTERIOR DECORATION—2. Contract Interior Decorating



A modern theater lobby with flowing lines counterpoised by trim furnishings.

Loew's Theaters



The curved, decorative wall and circling chairs effectively focus on the displays of merchandise in this department store.

Raymond Loewy Corporation

INTERIOR DECORATION—2. Contract Interior Decorating



Voorhes Walker Smith & Smith

The conference room of a large bank, paneled and furnished in a rich Georgian style.



Strikingly patterned curtains add a lively note to this executive office designed by Jessie Porter Earnshaw.



Authenticated News

The main lounge of a luxury liner, featuring subdued lighting, deep carpeting and overstuffed furniture.

INTERIOR DECORATION—2. Contract Interior Decorating



Above: A hotel dining room, by Henry End, A. I. D., with interesting wall treatment, geometric carpet design and dramatic lighting. Below: Inventive store decoration: a blend of sharply contrasting period and modern motifs.



Raymond Loewy Corporation

tains, and the floor may be of rubber tile, linoleum or cork, with or without rugs laid down over it. Furniture in the office may heighten the contemporary designing with upholstery in modern synthetic colorful fabrics. Wallpaper and photomurals showing scenes in a firm's factory are important means of conferring individual interest upon backgrounds. Nothing will aid so much in making an office gain in quiet repose as the alteration of objectionable architectural details such as piers, door openings and overhead beams, into a balanced symmetrical arrangement of background areas. Sprinkler system outlets and ceiling beams can be eliminated by furring down the ceiling, but if this is impractical, false beams can be added to balance the existing ones which happen to be off-center. Where an off-center door cannot be changed, a balanced effect can be obtained by placing a symmetrical, but false, twin in the same wall; in the same manner, a window that does not give sufficient light or is disturbing to the architectural composition may be eliminated by covering it with a Japanese shoji panel, illuminated from behind, if in a contemporary room, or covering it with a panel matching the wall and eliminating it altogether but leaving the glass and mullions undisturbed.

Restaurants and Cocktail Lounges.—The contract interior decorator commissioned to decorate and furnish a restaurant or cocktail lounge has a greater responsibility than merely the creation of a beautiful background. He must produce a furnishings plan, and reckon with a fickle public demanding easy traffic lanes, comfortable seating furniture, easy access to checking facilities, rest rooms and a score of other conveniences never encountered in residential planning. He must also provide quick service by the restaurant staff; and this calls for proper location of pantries, food checkers and service bars—all with an eye upon the size of the investment. There should be a definite relationship between the quality of the furnishings and the character of the patronage to be served: the night club represents the more sophisticated interior, but the tea room, the chop house, the chain restaurant, each represents its own degree of sophistication, also. Appropriateness of style, quality and cost for each type of operation, are therefore the principal conditions which should govern the effort of the interior decorator if he is to produce for the owner a proper return on his investment. Restaurant furniture must be designed to give the utmost sturdiness consistent with good proportions; the quality of the carpets, china, silver and glassware must stand up under the vicissitudes of public use. Repairs and costs of replacements affect maintenance expenditure so that profits can quickly disappear if the interior decorator overlooks this important factor. Therefore contract decorating invariably represents a compromise between the most desirable materials and the minimum cost, as well as between the most impressive decorative effect and maintenance, and between the most attractive colors and durability.

Schools and Hospitals.—In the decorating of schools and hospitals and other institutions there has to be borne in mind the fact that maintenance budgets are invariably low, and therefore the interior decorator must exercise care that he does not overlook practicality. In private schools, colleges and universities there are many types of classrooms naturally not existing in the elementary and secondary public schools, and each pro-

vides its own problems. Furniture, fabrics and other materials should be considered carefully for durability. In classrooms, the color of the walls should reflect the maximum amount of light without being in a glazed finish; and where blinds are used, they should be the same color as the walls. An attractive scheme may have dado, metal parts of desks and trim in the same color, with the walls and ceiling a light complementary color; and if the floor is rubber or asphalt tile in color, it may be brought into the decorative scheme also. Rooms on the north side of the building may, with good effect, be made warmer in color. Auditoriums offer special problems, for here hard wear is at its worst. A wainscot is essential, and it should be of a durable material. The ceiling and walls should receive acoustic analysis, and the materials chosen will enter into the decorative scheme. Flooring for the aisles should be selected for quietness, and, if sloping, a slippery surface is to be avoided. The problem of decorating interiors for schools offers intriguing possibilities as well as serious responsibilities inasmuch as the quarters in which maturing students work and play may well have a vital influence on their later lives, because the artistic taste of many of these young people is being formed at school far more than it is at home. Invariably the architectural background will set the style, but the interior decorator must also be governed by the need for simplicity, durability and ease of upkeep.

Hotels and Ships.—The first essential step in decorating the hotel or ship (for the average de luxe steamship resembles a hotel in many ways) is to ascertain the function of the various rooms to be decorated and to apportion each, depending upon its importance, a relative share of the allotted expense in the estimate. Once the purpose of the space is established, a logical solution can then be reached in the problem of furnishings. The great metropolitan hotels that offer sophisticated activities naturally will demand spacious and luxurious settings which are unsuited for the commercial hotel catering to a general patronage requesting merely pleasing surroundings. Between these two types lies the medium for the smaller residential hotel. Lobbies and lounges give the guest his first impression, therefore it is essential that they be as attractive as possible. The plan should provide an air of spaciousness in order to relieve any feeling of crowding, and one group of furniture should not interfere with another. Much of the dignity of the public rooms will depend upon the draperies and carpets. Expensive furniture and textiles lose their effectiveness by bad groupings and inharmonious color schemes. Simple, straightforward formal groupings without benefit of pictures, sofa pillows or small mirrors should be the rule. The decorative possibilities of halls and passageways should not be overlooked; settees and benches and console groupings, with accompanying pictures and lamps—either to break a long wall or to form a focal point at the end of a corridor—will contribute much charm. The restaurant, because it is occupied only during infrequent intervals, offers an opportunity for a more dramatic decorative treatment than does the lounge or lobby. The expanse of white in the dining room, in the napery, can be counteracted by draperies and wall covering and by colorful china; or it can be turned into a decorative advantage. Creating guest-rooms which are practical as well as attractive

requires the decorator's best efforts, because every decorative scheme is multiplied throughout the various rooms. Although the furniture will be simple of line, assertive notes of color will appear in bedspreads, draperies, lamps and the upholstery. The complicated problem of color schemes for a vast number of rooms is very simply solved by specifying draperies, carpets and bedspreads which can be used interchangeably throughout, provided there is no feeling of monotony. Transient guests require rooms in which comfort with charm is the distinctive note, but in many hotels the decorator will have an opportunity to employ door beds, dressing closets and sofa-beds to advantage in enabling the guest to convert the room which functions as a living room by day into a bedroom at night. China, linen, carpets and draperies for use in a hotel demand special consideration; therefore furnishings for minimum depreciation should be selected, with their practicality as well as beauty considered. Another matter to consider in relation to the depreciation of furnishings is their renovating and maintenance. The selection of drapery and upholstery fabrics will be particularly affected, and careful thought must be made of textures as well as colors and patterns. Other items to be considered in the upkeep expense include carpets, bedspreads, linen, wall coverings, woodwork and furniture.

Transportation.—In the office of the interior decorator, decoration for transportation proceeds from a thorough study of current and future trends. By expressing the romance and luxury of travel, the contract interior decorator dramatizes the quality of service offered passengers. This is accomplished in a different manner for each form of transportation. Interiors for ships are cruise-conscious, with forms and colors stylized and adapted from shipping and marine motifs setting the spirit; for air travel, speed, lightness and safety are emphasized, and colors are restful and textures are luxurious; train and bus interiors stress speed, comfort and dependability. Color psychology is exploited, with aesthetics of line, proportion and balance the real considerations; textures, materials and lighting arrangements are juggled to satisfy in the finished interior a cultivated appreciation of the appurtenances of comfortable travel. In airplane design, weight reduction is an important consideration, and decoration is successful insofar as it recognizes this factor. For example, by using specially designed lightweight carpet for floor covering, the greater weight of an equal amount of carpeting is eliminated, and more pay load can be carried and the margin of safety increased. Soothing color schemes and lighting are used to calm the hyper-nervous air traveler. Illumination presents difficulties, since the plane must carry its own source of generating power; and efficiency is paramount since the wattage is necessarily lower. In decorating for aircraft, the added exigency of weight reduction in this lighting system is a major factor. All ocean lines, airplanes and trains must, of course, be fireproof, therefore metal furniture and fireproof fabrics are specified. Careful and extensive research into the limitations and possibilities of these and other less commonly used materials is incumbent upon the designer. For ships, floor coverings are specified which will not be slippery in a heavy sea; and metal finishes must resist the ravages of salt air.

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INTERJECTION, ʔn-tēr-jěk'shŭn, a word thrown in, to express some sudden emotion or passion; an exclamation such as ah! alas! ouch! Interjections are hardly considered parts of speech and never form grammatical parts of a sentence; they are rather direct expressions of feelings which articulate speech attempts to describe or define. See also GRAMMAR—*Parts of Speech*.

INTERLAKEN, ʔn'tēr-lä-kěn, or ʔn-tēr-lä'kěn (meaning "between the lakes"), town, Switzerland, in Bern Canton, 26 miles southeast of the town of Bern. It is beautifully situated near the left bank of the Aare River in the valley of Böödel, between the lakes of Thun and Brienz. It is the largest resort in the Bernese Alps. The main street is famous for its view of the Jungfrau. Industries include the manufacture of woolen textiles and printing. It contains a beautiful old castle and numerous hotels and is the starting point for many tourist excursions into the surrounding Alps. Pop. (1954) 4,368.

INTERLUDE, ʔn'tēr-lŭd, in drama, a sort of play popular in the 15th and 16th centuries. It was the successor of the morality play (q.v.) and differed from it chiefly in being shorter and prevalently comic in tone, often to the point of farce. It too relies, particularly in early examples, on allegorical characters. John Heywood, a courtier-wit in favor with Henry VIII and Mary I, was the first considerable writer of interludes. Some of his best pieces, in which Sir Thomas More was possibly a collaborator, veer close to Ben Jonson's excellence in comedy-farce. Easily performed by amateurs, even by villagers for the amusement of the lord of the manor, the interludes won a grateful public who relished their broad humor and attacks on great men disguised as types.

Much has been written on the origin of the term. Probably Sir Edmund Kerchever Chambers rightly considered it a play (*ludus*) between (*inter*) two or more actors. Eric Partridge, in *Origins*, has for *interludium* "a game between two periods of business"; the business could be a long morality play or some official occasion.

WALLACE BROCKWAY.

INTERLUDE, in music, generally a piece played either between other pieces or between sections of a single piece. Although applied loosely to entr'actes, *intermedii*, *intermezzi*, and even wholly independent compositions of tentative or intermediate nature, the word has a specific meaning as applied to brief organ improvisations heard between strophes or verses of a psalm or hymn in Roman Catholic churches from the early Renaissance forward. Somewhat related improvisatory interludes were at times played between lines of a chorale in Protestant churches, notably in Germany, a familiar composed example being Johann Sebastian Bach's *In dulci jubilo*.

HERBERT WEINSTOCK.

INTERMENT. See BURIAL; DEATH CUSTOMS AND RITES.

INTERMETALLIC COMPOUNDS, in-
tēr-mē-tāl'lik kōm'pōundz, combinations of two or more metals representing a particular atomic ratio, such as GaAs or AuZn₃. They are generally markedly different from pure metals or solid solutions of the component metals. The compounds are usually hard and brittle substances, and the electrical conductivity is often low compared to the elemental metals. Because of these quasi-metallic properties, the intermetallic compounds are important as semiconductors and useful constituents in many alloys, where they act as hardeners. Since the ordinary rules of chemical valence and stoichiometry are often violated in these materials, it is apparent that the chemical bonding in intermetallic compounds is unlike that in such compounds as NaCl. On the basis of the bonding, there are three different categories of intermetallic compounds: *electron compounds*, *valency compounds*, and *interstitial compounds*.

Electron compounds exhibit specific electron densities. The British metallurgist William Hume-Rothery (1899—) observed that valency electrons to atom ratios of 3:2, 21:13, and 7:4 exist in a large number of intermetallic compounds. Examples of the 3:2 ratio are CuBe and Cu₃Al, where copper has one valence electron and beryllium and aluminum have two and three respectively. Other examples are Cu₃Cd₂ (21:13 ratio), and Ag₃Al₂ (7:4 ratio). Electron compounds generally exist over a range of composition, and the bonding is essentially metallic. They are often good electrical conductors. Some are plastic, but those having complex structures such as Cu₃Al₂ are brittle.

In the valency compounds the normal rules of chemical valence apply. The atoms may be held together by either ionic or covalent (homopolar) bonding or a combination of both. In the ionic compounds one metal atom tends to give up its valence electrons to the other. This requires a marked difference in the electronegativity of the atoms. Examples are MgSe, BaTe, and Mg₂Pb. In the covalent compounds the atoms tend to share the electrons, often in a tetrahedral bond arrangement. Elements of Group III and Group V frequently form covalent compounds such as InSb and GaAs. Valency compounds are generally semiconductors, and are usually hard and brittle.

The interstitial compounds make up a very important class, in which size factors are significant. There are often large differences in the atomic diameters. Although carbon and nitrogen are considered nonmetals, the carbides and nitrides of the transition metals are classified as interstitial compounds. They are very hard and brittle materials, having high melting points. The hardness of many alloys is due to such interstitial compounds as Fe₃C, Fe₃N, WC, and MoN. In the case of the transition metals, the bonding appears to be metallic, and the compounds are electrical conductors. In the case of the more electropositive metals the bonding may be valency, and such compounds as CaC₂ and BaC₂ are poor conductors.

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INTERMEZZO, in-tēr-mēt'sō (Lat. *intermedius*, intermediate), in music, a term with several applications. In the 18th century, *intermezzi* were brief comic episodes sung between acts in *opere serie*. Becoming detached from the parent operas, they evolved into *opera buffa*. The famous *La serva padrona* of Giovanni Battista Pergolesi was at first an intermezzo between the acts of his serious opera *Il prigionier superbo* (1733). In the 19th century, the word was applied (1) to independent brief piano pieces of rather informal nature (Schumann, Brahms), perhaps because they were composed between pieces of greater importance, an idea related to Beethoven's use of the term for a linking movement in his "Waldstein" Sonata in C major, opus 53; and (2) to orchestral entr'actes in operas (as in Pietro Mascagni's *Cavalleria Rusticana*, 1890, and Giacomo Puccini's *Manon Lescaut*, 1893). Richard Strauss' opera *Intermezzo* (1924) was so called because of the parenthetic character of the events of its libretto.

HERBERT WEINSTOCK.

INTERNAL COMBUSTION ENGINE, in-tūr'nāl kōm-būs'chūn, a heat engine in which the fuel is burned (that is, united with oxygen) within the confining space of the engine itself. This burning process releases large amounts of energy, which are transformed into work through the mechanism of the engine.

This type of power plant differs from the steam engine, which uses an external combustion process because its fuel is burned apart from the engine (and under a boiler to convert the water in the boiler into steam, which then flows to the engine to expand and do work).

In general, it cannot be said that the internal or the external combustion process is inherently more efficient. As a practical matter, the internal combustion engine has the advantage on the high-temperature side, while the external combustion or vapor cycle does better on the low-temperature side. In most cases, it may be obvious which type of engine would be more efficient, but sometimes a complete analysis may be required.

In general, the internal combustion engine has become the means of propulsion in the transportation field, with the exception of large ships requiring over 4,000 shaft horsepower (hp.).

In stationary applications, size of unit and local factors often determine the choice between the use of steam and diesel engines. Diesel power plants have a distinct economic advantage over steam engines when the size of the plant is under about 1,000 hp. However, there are many diesel engine plants much larger than this. Internal combustion engines are particularly appropriate for seasonal industries, because of the small standby losses with these engines during the shut-down period.

History.—The first experimental internal combustion engine was made by a Dutch astronomer, Christian Huygens, who, in 1680, applied a principle advanced by Jean de Hautefeuille in 1678 for drawing water. This principle was based on the fact that the explosion of a small amount of gunpowder in a closed chamber provided with escape valves would create a vacuum when the gases of combustion cooled. Huygens, using a cylinder containing a piston, was able to move it

in this manner by the external atmospheric pressure.

The first commercially practical internal combustion engine was built by a French engineer, (Jean Joseph) Étienne Lenoir, about 1859-1860. It used illuminating gas as fuel. Two years later, Alphonse Beau de Rochas enunciated the principles of the four-stroke cycle, but Nikolaus August Otto built the first successful engine (1876) operating on this principle. (See Fig. 1.)



Fig. 1. Model of engine on which Otto secured his American patent in 1877; now in the Smithsonian Institution.

This engine also burned illuminating gas, but with increased efficiency because of compressing it before ignition. Otto secured an American patent in 1877.

The advantages of compressing the charge before igniting it were probably discovered by an Englishman, William Barnett, who patented the idea in 1838. Barnett also pioneered the two-stroke cycle, but Dugald Clerk, a Scottish engineer, contributed the most to its early development—to circumvent Otto's patents.

In 1892 Rudolf Diesel, a German, conceived the idea of igniting the fuel by injecting it into air that, by compression, had been heated to a point where its temperature would start combustion. Since then his name has been identified with the combustion or constant pressure type of engine, as distinguished from the Otto explosion or constant-volume type. (See Fig. 2.)

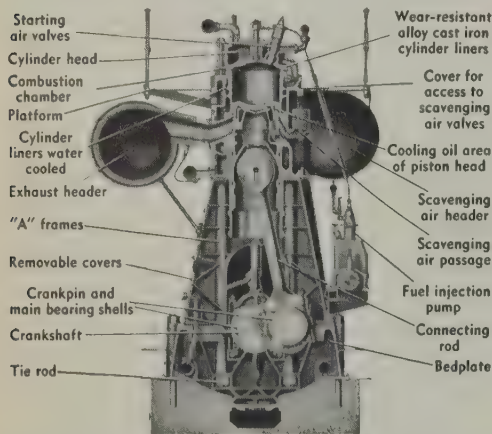


Fig. 2—Cross section of Nordberg two-stroke-cycle diesel engine for stationary applications.

Diesel's work was entirely with relatively large, slow-speed engines, but since his death (1913), high-speed diesels have been developed, employing a modification of the diesel cycle.

Contemporaneously with Otto's work in Germany, a Boston engineer, George Brayton, designed an engine to burn gasoline.

The means of igniting the combustible mixture passed through several stages before higher speeds and, hence, lighter engines could be made available for vehicles and boats. Otto used a flame to touch off the gas, and the best speed he could get was 150 to 200 revolutions per minute (rpm.). One of his workmen, Gottlieb Daimler, set up his own shop and developed what became known as hot-tube ignition. By regulating the heat of the tube, he could control the point at which ignition took place. In 1883 he succeeded in attaining 800 to 1,000 rpm.—speeds high enough to make the automobile practicable.

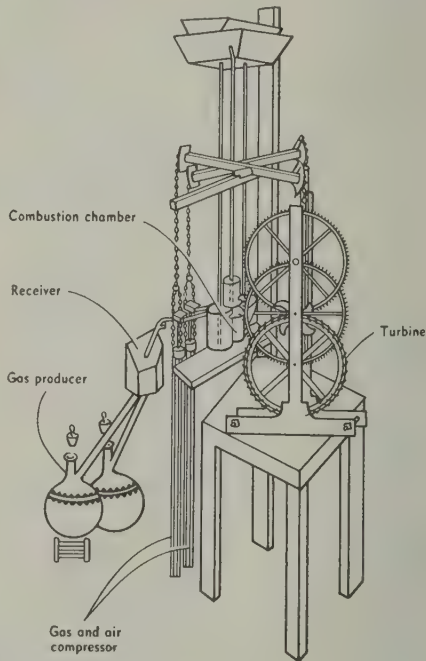


Fig. 3. Gas turbine patented in 1791 by John Barber.

Attention was then turned to the development of carburetors by which gasoline could be atomized or vaporized to substitute it for gas as a fuel, making the use of internal combustion engines possible in portable applications. Daimler in Germany and Fernand Forest in France both accomplished this in 1885. Daimler had the better engine, but Forest developed the better carburetor.

Daimler forced air through the liquid fuel, and the entrained particles, by contact with the hot tube, were gasified before igniting. Forest sprayed the fuel into a stream of air, on the principle of perfume atomizers or insecticide sprayers. Later, an associate of Daimler's, Wilhelm Maybach invented the float-feed carburetor, which has become the accepted form.

Karl Benz, another German, taking Daimler's engine and Forest's carburetor, installed them in a tricycle, adding electric ignition. In 1885 he built the first gasoline automobile, which quickly became and still is the largest field of applica-

tion of internal combustion engines. (See *AUTOMOBILE—Automobile Engine*.)

The principle of the turbine has been known for a long time. About 100 A.D., Hero, the Alexandrian philosopher, built a reaction turbine, which converted steam pressure into mechanical power.

This invention, as well as Giovanni Branca's steam jet-operated turbine of 1629, was the inspiration for later inventors in their attempts to substitute combustion products for steam as a more convenient method of power generation by means of a turbine.

John Barber was the most outstanding of these early inventors in his recognition of the possibilities of the internal combustion turbine. His patent of 1791 is the first recorded description of a gas turbine. (See Fig. 3.)

The next important step was taken by René Armengaud and Charles Lemale, who started building gas turbines in 1894, which it is claimed worked satisfactorily for several years, although at a low thermal efficiency.

By the beginning of the 20th century many other turbines were being built, such as the Stolze air turbine and the Holzwarth constant-volume gas turbine.

Other work was being done by Charles Gordon Curtis, who patented a gas turbine in 1895 and Dr. Sanford A. Moss, who, in 1902, was operating a de Laval turbine with the aid of combustion products.

The Britisher, Frank Whittle, is credited with having devised the first practical solution to the problem of aircraft propulsion by thermal jet reaction using a gas turbine-compressor unit. His original patent was dated 1930 although it

doing important research: Junkers, Heinkel-Hirth, and BMW (Bavarian Motor Works). Out of this work came the development of a jet engine that was installed in an HE-178 (Heinkel-Hirth). It flew in August 1939—the first jet-propelled aircraft to fly.

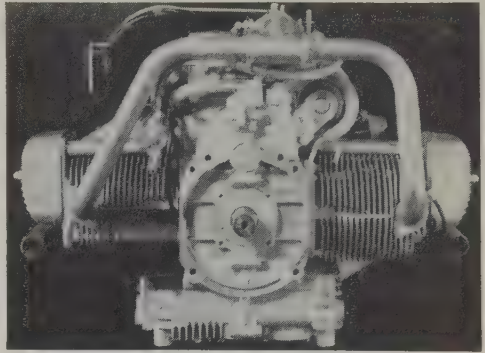


Fig. 5. Horizontal arrangement of cylinders is shown by this two-cylinder, four-stroke, air-cooled gasoline engine built by Outboard Marine Corporation. Producing 18 hp. at 4,000 rpm., it can be used as power source for utility vehicles, pumps, compressors, and the like. Shown here is the rear view (power takeoff end).

Classification.—The principal types of internal combustion engines are: reciprocating engines, such as gasoline, diesel, and gas engines; and rotary engines, such as the turbine engine.

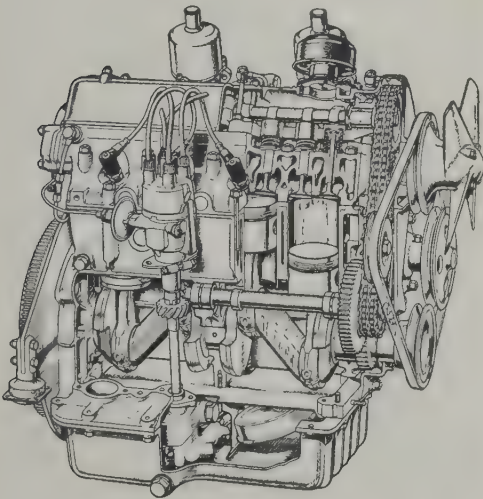


Fig. 4. Arrangement of engine with vertical cylinders is shown by this four-cylinder, four-stroke, water-cooled gasoline engine built by Coventry Climax Engines, Ltd. (England). It produces 40 bhp. at 4,000 rpm., and is used as a fire pump engine.

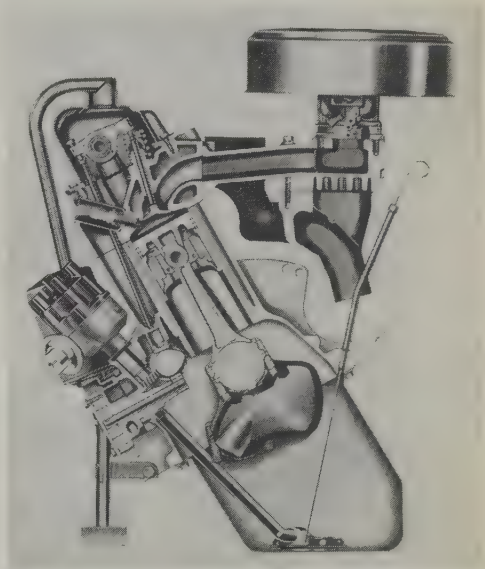


Fig. 6. Chrysler Corporation's Slant-6 engine is a modern version of the inclined cylinder. The engine is tilted 30° for most efficient use of engine compartment space. It produces 145 bhp. at 4,000 rpm., and has many aluminum parts, the largest being the cylinder block.

was not until 1944 that an aircraft employing his ideas was actually flown by the British Royal Air Force and the United States Air Force.

Meanwhile, several German firms had been

Reciprocating Engines.—In the reciprocating engine, power is transformed into work by the reciprocating action of a piston. Piston engines come in all sizes from the tiny model air-

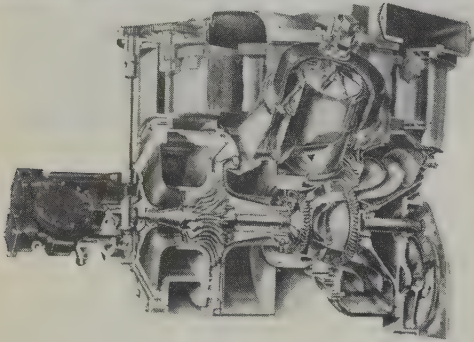
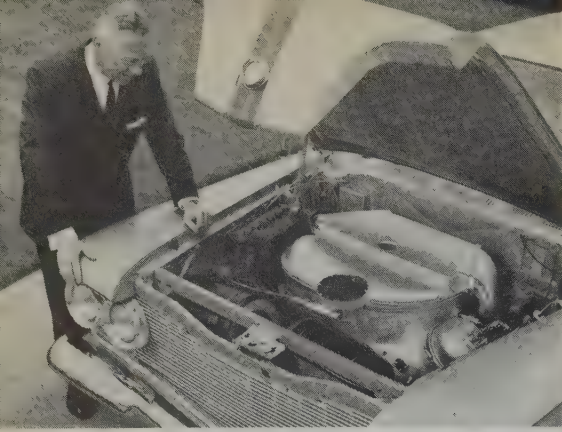


Fig. 7. Chrysler experimental gas turbine being developed for potential automotive, marine, and industrial applications produces 140 hp. The unit weighs 450 pounds, considerably less than a comparable piston engine. Top: The gas turbine installed in a Plymouth passenger car. Bottom: Cutaway view of the experimental turbine unit.

plane to large diesel engines of many thousands of horsepower. (See Fig. 2.)

Reciprocating internal combustion engines have been classified in many ways, such as:

(1) According to the ideal cycle that should be used as a standard of comparison with the real engine, such as the constant-volume cycle and the constant-pressure cycle.

(2) According to the number of strokes of the piston necessary to complete one power cycle: the four-stroke cycle and the two-stroke cycle. (A few highly experimental engines have also been built to operate on a six-stroke cycle, but none have been practical.)

(3) As to whether the engine is single acting or double acting; that is, whether the piston receives pressure on only one of its sides or on both sides. Most internal combustion engines are single acting, although a few double-acting ones have been built in large sizes for stationary applications. While the double-acting engines produce about twice the power of the single-acting ones of the same bore and stroke, there are mechanical difficulties in that limit the use of this type.

(4) According to the fuel used: gas, gasoline, or fuel oil.

(5) According to use: automotive, aircraft, marine, stationary, or portable.

(6) As to the arrangement, position, and number of cylinders. The axes of the cylinders may be vertical (Fig. 4), horizontal (Fig. 5), or inclined (Fig. 6). The cylinders of multicylinder engines may also be arranged side by side (Fig. 4), or they may be end to end (with pistons opposed, as shown in Fig. 5); they may be radial, or they may be inclined in banks, as in the V type of engine.

There are other variable characteristics that are often pertinent to the description of a given engine; for example, the method of governing, the method of introducing fuel into the combustion space, and the arrangement of the valves.

Rotary Engines.—Progress is constantly be-

ing made in the design and application of gas turbines for stationary use and for locomotive, marine, and automotive propulsion (Fig. 7) purposes, but the applications are either experimental or extremely limited. It is in the high-speed aircraft field that they have found their main application, where they have practically replaced the piston engine.

Gas turbines can be classified as follows:

(1) Constant-pressure turbine, in which the turbine wheel is actuated continuously by the products of combustion admitted from the combustion chamber. (Actually, pressure does vary under load changes, so a better name would be continuous-combustion turbine.)

(2) Explosion or intermittent-combustion turbine operating according to the constant-volume-cycle method. (An example is the German Holzwarth gas turbine.)

(3) Open-combustion-chamber turbine, in which heat is supplied while both pressure and volume are changing. (The Karavodine turbine built in 1908 is an example.)

The latter two types are little used today. The constant-pressure type has pretty well taken over, being used in aircraft, as well as most other turbine power plants.

There are three major types of aircraft turbine engine: (1) turbojet, (2) turboprop, and (3) turbofan.

These engines all have a gas turbine as an integral part of the design. Other types of aircraft or space vehicle engines having some form of turbine in their design include: the ramjet or athodyd, the rocket engine, and the pulsejet or flying bomb—the V-1 of World War II.

(For further information about aircraft power plants, see AERONAUTICS—4. *Flight Propul-*

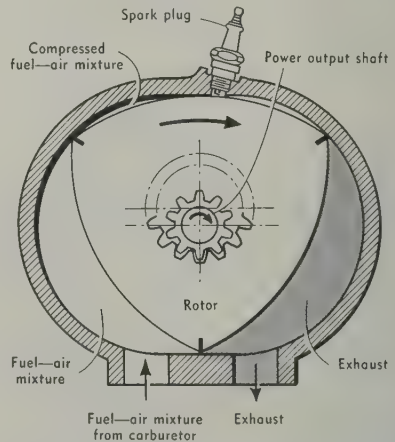


Fig. 8. The Wankel rotating combustion engine has only two major rotating parts—the triangular rotor and the crankshaft (output shaft). As the rotor turns inside the housing, a fuel-air charge is drawn in through a fixed port, compressed, and ignited when it passes the spark plug. The expanding gases push the rotor around until they can exit through the exhaust port.

sion; ROCKETS; JET PROPULSION.)

Through the years many unusual types of rotary engine have been designed, and some of them have been built. A few of them even worked—after a fashion. In theory, at least, the rotary engine seems like a much better idea than the crude piston-rod and crank arrangement and the even cruder poppet valve device, but (except for the turbine engine) it just never seemed to work out. Then, Felix Wankel, a Ger-

man, came up with an idea for a rotary engine that, by the late 1950's seemed to have possibilities. Called the "rotating combustion engine," it consists of a housing with a wasp-waisted cavity within which an inner, roughly triangular rotor rotates, as shown in Fig. 8. As of 1961, only gasoline versions operating on the four-

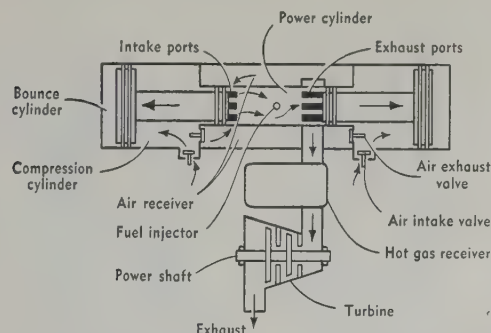


Fig. 9. Free-piston engine produces hot gases formed by diesel combustion in the power cylinder. These drive the turbine, which, in turn, may drive the wheels of a vehicle.

stroke cycle had been built, but other types were contemplated.

Compound Power Plant.—Another type of engine is the compound power plant. Basically, it consists of a reciprocating engine plus some means—generally a turbine—for extracting energy from the exhaust gas and converting it into power.

One version of the compound engine is the free-piston-turbine engine. Here, as shown in

Fig. 9, the unit produces hot gases which are used to drive the turbine, which in turn can be geared to the wheels of a vehicle.

The Cycle.—The processes that take place in regular sequence in any internal combustion engine are as follows: (1) induction, (2) compression, (3) combustion and expansion, and (4) exhaust. When an engine goes through this series of processes once, a cycle is said to have been performed.

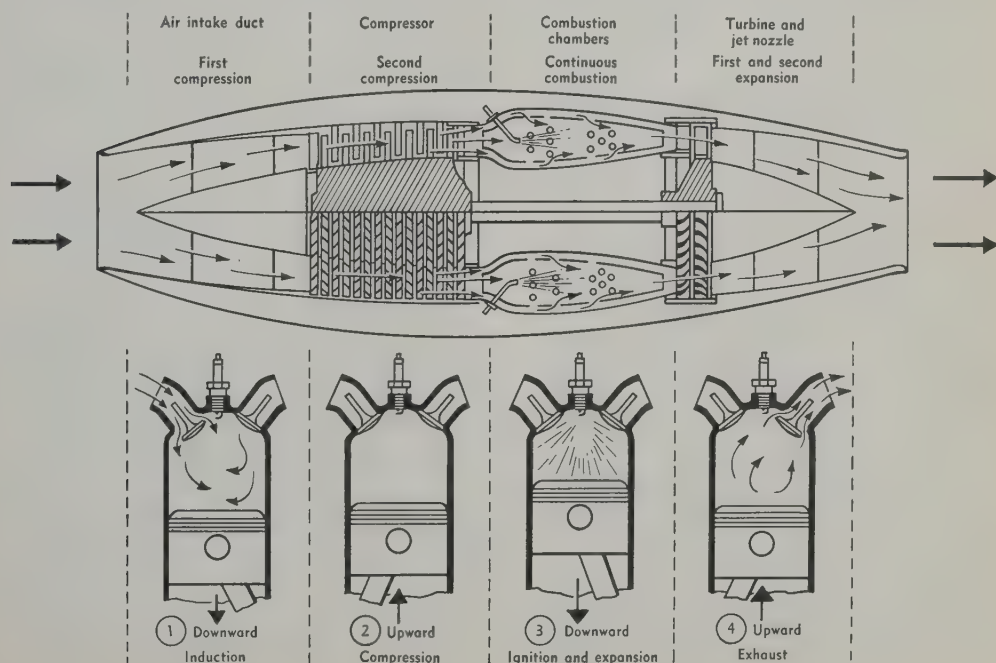
Although there are many types of cycles, the ones in greatest use today are (1) the Otto cycle, in which the fuel is burned at essentially constant volume (used mainly in gasoline engines); (2) the diesel cycle, in which the fuel is burned at constant pressure (used in low-speed diesel engines); and (3) a modified diesel cycle, in which the first portion of the fuel is burned at approximately constant volume and the last portion at nearly constant pressure (used in high-speed diesel engines).

The constant-volume and constant-pressure processes were originally developed for reciprocating engines, but modifications of them are also used in turbine engines.

In fact, although turbine engines and reciprocating engines are quite different mechanically, the series of operations is basically the same for both power plants, as shown in Fig. 10. The only real difference is that in the turbine engine employing constant-pressure combustion power is produced continuously, whereas in the reciprocating engine it is produced intermittently. (In the constant-volume-combustion turbine, power is produced intermittently.)

The operation of the reciprocating engine shown here (a four-stroke Otto cycle engine) is as follows: on the first downward stroke of the

Fig. 10. Comparison of rotating and reciprocating engines. In the lower series of diagrams, the four intermittent strokes of a reciprocating engine are approximately aligned with the four continuous functions of the turbojet engine above them.



piston, a mixture of fuel and air enters the cylinder around the open inlet valve. When the piston reaches the bottom of its stroke, the inlet valve closes so that on the return upward stroke the charge is compressed. When the piston reaches approximately the uppermost point of travel (top dead center), the charge is ignited by the spark. Then the expansion of the gases resulting from combustion forces the piston downward again for the power stroke. Finally, the second upward stroke of the piston drives the burned gases out of the cylinder around the open exhaust valve.

The turbine unit shown in Fig. 10 is an aircraft turbojet engine with a multistage axial compressor and a single-stage turbine. Air enters the front of the unit and is compressed by degrees as it passes through the several stages of the compressor. From here it enters the combustion chambers into which kerosene is sprayed and burned continuously. The tremendous heat released by the combustion of the fuel expands the gases but, as the chambers have open ends (in contrast to the closed cylinder of a piston engine), there is no rise in pressure.

By reason of the rapid expansion, the heated gases force their way at increased velocity through the only exit from the chambers, namely, between the guide vanes in the stator ring of the turbine. These vanes direct the flow to the approximate angle of attack for the blades of the turbine, causing the turbine wheel to rotate at very high speed. In this manner, power is developed to drive the compressor fixed at the front end of the shaft.

After the gases have passed through the turbine they escape through the rear of the unit. This mass of gases being projected rearward at high velocity produces a force that drives the airplane forward.

Although most reciprocating gasoline engines operate on the four-stroke cycle, that is, one cycle is completed in four strokes of the piston or two revolutions of the crankshaft, the outboard motor is an example of a two-stroke-cycle gasoline engine.

As shown in Fig. 11, the same events take place with the exception that they are accomplished in only two strokes of the piston or one revolution of the crankshaft since the piston is not used to expel the exhaust gases and suck in the fresh charge. Instead, while the piston is at the bottom of its stroke, the fresh charge is injected under a slight pressure so that it sweeps out the spent gases. A deflector on top of the piston, as shown in Fig. 11, directs the incoming charge toward the top of the cylinder to do this.

In engines employing the diesel cycle, air alone is drawn into the cylinder and compressed to 500 or more pounds per square inch (psi.). This compression raises the air temperature to the point where, as soon as fuel is injected, combustion occurs, without the help of a spark. The burning takes place at nearly constant pressure.

In the modified diesel cycle, fuel injection is started early enough so that part of the fuel burns at constant volume and the balance at constant pressure.

Engines operating on this modified cycle have compression ratios higher than are customary with the Otto cycle but lower than the usual diesel compression ratios. This necessitates the use of glow plugs, hot bulbs, or similar devices to facilitate starting.

The two-stroke cycle is more suited to the diesel cycle than to the Otto and is thus more widely used in engines employing this cycle. There is no fuel in the intake charge of air, which is used to scavenge the cylinder and thus an excess wastes no fuel. As in all diesels, the fuel is not injected until after the compression of the air.

Gas Turbines.—In its simplest form, a gas turbine power plant consists of: air compressor, combustion chamber, and turbine wheel.

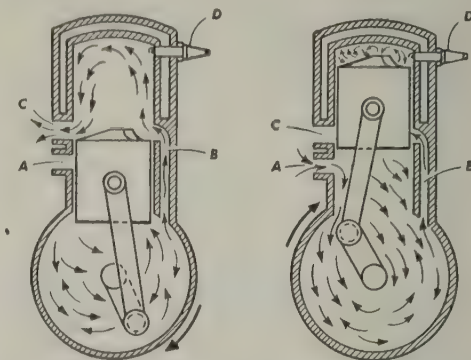


Fig. 11. Events in two-stroke-cycle engine with crankcase scavenging. Left: Down or power stroke; right: up or compression stroke. Intake and exhaust take place at end of power stroke and start of compression stroke. A, intake port to crankcase; B, transfer passage; C, exhaust port; D, spark plug.

The compressor and turbine are mounted as a single rotating unit. After the power plant has been started by an auxiliary power source such as an electric motor or a piston engine, some of the power developed by the turbine is used to drive the compressor. Thus, the output of the turbine engine is the difference between the turbine power and the power required to drive the compressor; it is obvious, therefore, that the efficiency with which the compressor delivers air is of paramount importance.

Two main types of compressors are used on turbine engines: the centrifugal and the axial (as shown in Fig. 10).

The compressed air flows from the compressor to the combustion chamber, where it unites with the fuel, generally kerosene, which is injected through nozzles. A high-voltage spark is used to initiate combustion, after which the spark can be cut off.

The turbine itself consists of a shaft to which are attached the blades against which the high-velocity, high-temperature gases impinge to develop power. Suitability for high-temperature operation is essential for turbine materials. In fact, the major developments that made possible the commercial use of the internal combustion turbine were in metals that retain substantial strength at temperatures of 1200° F. and higher, and in more efficient compressors.

The speed with which the gases pass through the turbine creates special problems of erosion. Also, the materials used must not be prone to "creep" or grow with cyclic variations of temperature (that is, repeated heating and cooling in service).

To achieve higher efficiencies than are possible with the simple gas turbine unit, the three

basic components may be used in multiple and in various arrangements. They are also often augmented by other components such as the regenerator (to recover waste heat and transfer it to a point where the temperature is lower and the pressure higher) and the intercooler (to remove heat from the working medium between stages of compression).

Compared with the reciprocating aircraft engine, the turbine unit has lower specific weight, adaptability to much higher speeds, and the upper limits of thrust capacity of a single unit are much greater. On the other hand, the turbojet version has considerably higher fuel consumption and it is not adaptable to low-speed, light planes. Turboprop units do, however, extend the range of gas turbines to lower-speed applications and have improved fuel consumption. Significantly better fuel economy is also claimed for the turbofan engine.

Compared with the diesel, for example, as applied to locomotives, simple gas turbines use less space, are lighter, and presumably would require less maintenance. Their chief disadvantage is the poorer fuel economy. Also, the output of the gas turbine is more seriously affected by adverse atmospheric conditions of temperature and altitude than is the diesel.

Although further developments may permit favorable comparisons with the steam plant, at present the comparison is unfavorable to the gas turbine. The long-time reliability of the steam plant has not yet been demonstrated by the turbine. The compressors are far larger than the corresponding feedwater pumps. The plant capacity is more sensitive to deterioration of turbine and compressor efficiency. Thus far, the single-unit capacity of the gas turbine is also considerably short of that for large steam turbine installations.

Mechanically the gas turbine unit is quite different from the reciprocating engine. There are no pistons, valves, or ignition apparatus (save for ignition plugs to start combustion of the fuel). After starting, no warming up period is necessary, as bearings are few; there are no metal-to-metal sliding surfaces; consequently, only a simple lubrication system is needed.

Compared with piston engines, turbine units are also:

- (1) Less critical regarding type of fuel. High heat value, not antiknock rating, is the criterion.
- (2) Virtually vibrationless because of the exclusive use of rotating components.
- (3) Self-cooled by airflow, so that no radiator or projecting air scoops are required.

For further information about gas turbines see ENGINE; JET PROPULSION; AERONAUTICS—4. *Flight Propulsion*.

Reciprocating Engines.—Indicator Cards.—The events that occur in any reciprocating engine may conveniently be pictured by a graph with pressure plotted along the vertical distance (ordinate) and actual volume in the combustion space as the horizontal distance (abscissa). These plots are called indicator diagrams or cards.

Various types of indicators have been developed that give an accurate plot of this pressure-volume relationship for an engine in actual operation. For a low-speed engine the mechanism of this indicator can be relatively simple, as shown in Fig. 12.

This device is unsuited for high-speed engines, however, because of the inertia effects of its moving parts and the pencil friction, which

are excessive at high speeds. Other mechanical indicators, as well as optical and electrical indicators, are available that avoid these errors for high-speed work.

Air-Fuel Mixture in Otto Engines.—Theoretically, 15 pounds of air must be mixed with each pound of gasoline in order to supply

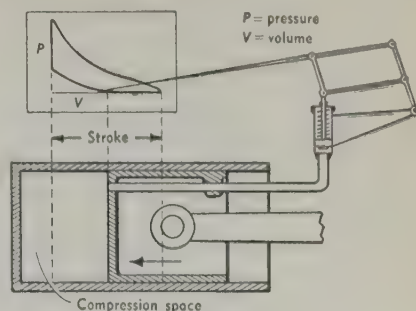


Fig. 12. Schematic diagram of indicator for recording cylinder pressure changes in low-speed engine.

just enough oxygen to complete the combustion of the fuel. In actual practice, however, it is seldom that this exact ratio of air to fuel is used. For maximum economy, such as is desired for normal operation, more air must be supplied (usually about 16 to 17 pounds of air per pound of fuel); otherwise combustion will be incomplete and some of the fuel wasted; that is, it will pass through the engine unburned or partially burned.

There are several reasons why this extra air is needed: (1) A thoroughly homogeneous mixture of air and gasoline cannot be obtained in the very short time available, so that all the fuel particles can react with all the oxygen particles. (2) In a multicylinder engine, it is practically impossible to get an absolutely uniform distribution of fuel to all the various cylinders, some cylinders always receive richer mixtures (that is, containing a higher proportion of fuel) than others. (3) The dilution of the mixture by the exhaust products left in the clearance space reduces the probability that all the fuel particles will react with oxygen particles.

When the air/fuel ratio is increased above 16 to 17, the efficiency begins to drop off. When the ratio gets above 18, the mixture becomes so lean that the drop in efficiency and loss of power become quite rapid. Finally a point is reached where combustion does not occur at all.

On the other hand, greater power is obtained (although at the expense of efficiency) with a richer mixture than 15 to 1. Greatest power (such as is needed for quick acceleration and maximum speed up grades) is obtained with air/fuel ratios of 12 to 13.

Thus we see that the setting of the carburetor for maximum power is quite different from that for maximum efficiency. Moreover, for smooth idling of the engine, the mixture must be even richer, 11.2 being a typical figure. This very rich mixture is needed at idling speeds for two reasons: (1) because the pressure in the manifold system is below atmospheric pressure, thus inducing a leakage of air, which dilutes the mixture, and (2) because the amount of fresh mixture entering the cylinder is small, so that there is a relatively large degree of dilution of the charge

by the burned gases remaining in the cylinder.

The modern carburetor is designed to provide approximately these various air/fuel ratios: an economical mixture for the usual operating conditions, richer mixtures when the demand is for greater power, and an especially rich mixture for idling.

Carburetors.—The carburetor is used in engines employing the Otto cycle. Its function is to break up the gasoline into tiny particles and to mix it with the proper amount of air to give efficient combustion.

A simple carburetor of the float type is shown in Fig. 13. Gasoline is forced by the fuel pump into the float chamber shown at the right. The float, so called because it floats in the gasoline, acts to close the fuel intake valve when the gasoline reaches the proper level.

The suction stroke of the engine piston induces a flow of air into the carburetor, as shown at the left. This air passes through a narrowed section called the venturi. The purpose of the venturi is to speed up the flow of air so as to cause a decrease in air pressure to slightly below atmospheric pressure at its narrowest section, known as the throat.

Located at the throat is the jet or discharge nozzle, as shown in Fig. 13. Since the pressure in the float chamber is at atmospheric and that at the jet is slightly below atmospheric, gasoline is pushed through the jet and into the airstream. As the fuel leaves the jet it is atomized or broken up into small drops.

The greater the difference between atmospheric pressure and the pressure at the throat, the more gasoline flows into the air stream. If the jet and venturi are properly proportioned, there is an automatic action that results in greater fuel flow when the airflow becomes greater. When the throttle valve is opened wider, more air as well as more fuel is pulled in, so the proportions (the mixture ratio) remain roughly the same.

Actually, opening the throttle usually increases the speed of the engine, which in turn increases the suction. In the simple carburetor this causes the fuel flow to increase more than the airflow, so that a richer mixture is being supplied to the engine than required. For this reason modern carburetors have automatic compensating devices to maintain the desired mixture proportions at the higher speeds.

In actual practice it is also necessary to provide varied proportions: the richer-than-normal mixture needed for starting the engine, especially when it is cold; the slightly richer-than-normal mixture needed for quick acceleration and for maximum speed up grades.

These changes in mixture ratio are also effected automatically in carburetors built today. For example, at least two jets or fuel passages are provided from the float chamber to the venturi, one for idling and low-speed operation, the other for higher speeds or harder pulling. There are also various other auxiliary devices built into the carburetor, mostly to change the fuel/air ratio or to take care of some special condition.

One of these devices is the choke valve. It looks much like the throttle valve but it is located in the air intake passage of the carburetor. When it is partly closed, a high vacuum is formed beneath it. More fuel and less air are pulled in, giving the much richer mixture needed to start the engine. On most modern cars the choke

valve is controlled automatically; that is, the driver has no control over it.

The simple carburetor shown in Fig. 13 is of the updraft type; that is, the air enters the carburetor at the bottom and leaves it at the top. Today, on most vehicles at least, carburetors are of the downdraft type—the air enters at the top and leaves at the bottom.

The downdraft carburetor permits a manifold of larger cross section because the fuel flows down into the manifold instead of being lifted up into it. The location of the carburetor above the engine makes it more accessible for inspection, adjustment, and repair, and the air entering the carburetor is cooler.

Fuel Injection.—The heart of the diesel engine is its fuel injection system. Its purpose is to force a small amount of fuel (broken up

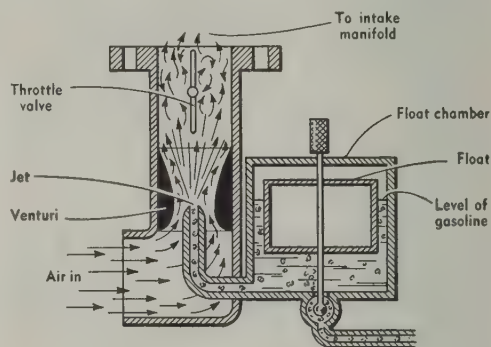


Fig. 13. Carburetor in its simplest form.

into finely divided particles) into the highly compressed, high-temperature air in the cylinder just before the piston reaches the top of its compression stroke.

There are two methods of injecting fuel into the combustion chamber: air injection and airless injection (also called mechanical injection and solid injection).

With air injection, the fuel is sprayed into the cylinder by means of highly compressed air. This method is little used, however, because it requires a compressor, which adds mechanical complexity and weight and consumes up to 10 per cent of the brake horsepower.

Today, therefore, the airless injection method predominates. There are many variations of this type, such as the unit pump injection system (Fig. 14) and the common-rail system.

In any solid injection system, it is necessary to have a pump that will force the fuel into the cylinder against the compression pressure of 500 to 600 psi. The volume of liquid to be injected is very small, and it must be injected at a very high velocity in order that it may be thoroughly atomized and yet be capable of penetrating through the whole volume of air. The jet must be so disposed and directed that a stream of liquid is not likely to impinge on the cylinder wall or piston, where rapid carbonization would occur.

With the unit injector, the pump and nozzle are combined in one unit, the whole mechanism being fitted in the cylinder head. It is operated by a rocker arm controlled by the same camshaft that operates the valves. The pump itself consists of a plunger fitting closely in a cylinder. There

are also means for varying the amount of fuel it pumps in one stroke. The plunger builds up pressure on the small amount of liquid in the cylinder until the pressure is great enough to open

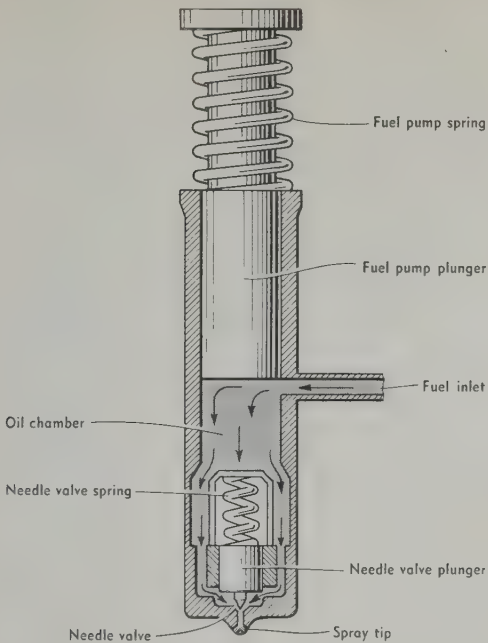


Fig. 14. Diagram of diesel fuel pump and injection nozzle.

a spring-loaded check valve. This may be as high as 20,000 psi. When it opens, the fuel is forced into the cylinder through a number of very small holes in the nozzle, shooting a fine spray in all directions.

Controlling the amount of fuel pumped by the injectors speeds up or slows down the engine, just as does opening or closing the throttle of a gasoline engine.

In the common-rail system, a constant pressure is maintained in the fuel discharge line, and the discharge to the cylinder is controlled by the lift, timing, and duration of opening of the fuel valve. One or more pumps are used to furnish fuel under high pressure to one pipe or reservoir having branches to all the cylinders.

Fuel injection has also been investigated for gasoline engines—both aircraft and automotive—and a few systems are being used. They are not more popular because they are much more complicated and expensive than carburetors, and improve power and economy only slightly. (See also FUEL INJECTION.)

Combustion Chambers.—The combustion chamber is the space at the head end of the engine where burning of the fuel occurs. In the diesel engine, since the fuel is injected after the air has entered the chamber, it is also the space where the fuel and air are mixed before and during the burning.

The combustion chamber must be designed most carefully since upon it depends in large measure how well combustion occurs, that is, how quickly, how completely, how smoothly, and whether with or without knocking.

In general, combustion chambers of four-stroke spark-ignition engines are classified according to valve arrangement and the degree of turbulence that is induced in the chamber during the burning process.

Common types of nonturbulent chambers include the T-head, L-head, F-head, valve-in-head, and domed-head designs (see Fig. 15).

The T-head is practically obsolete because it does not permit the use of high compression ratios and requires two camshafts.

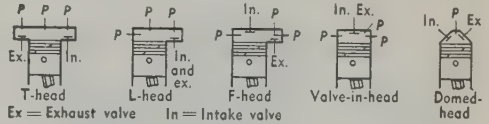


Fig. 15. Combustion-chamber shapes, valve locations, and possible spark-plug locations (P).

The L-head design, long used in the automotive field, has a more compact combustion chamber, permitting higher compression ratios, and requires only one camshaft; it is, however, restricted in valve size by the center-to-center distance between cylinders in a multicylinder engine.

The F-head permits large valves, requires one rocker arm mechanism for the inlet valve, has a slightly more compact combustion chamber, and permits a slightly higher compression ratio than the L-head design.

The valve-in-head design has a very compact combustion chamber, but it is restricted in valve size. It permits higher compression ratios than the foregoing designs, but it requires either rocker arms and pushrods or an overhead camshaft mechanism.

The domed-head is a modification of the valve-in-head design that permits large valves, has the most compact combustion chamber, and permits the highest compression ratio. It requires an overhead camshaft or otherwise complicated valve mechanism for cylinder in-line engines. Similar to this design is the wedge-shaped combustion chamber used by Chrysler Corporation in their Slant-6, die-cast aluminum engine (see Fig. 6).

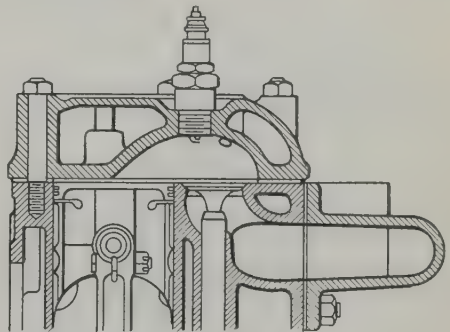


Fig. 16. Turbulence type of combustion chamber developed by Sir Harry Ricardo.

Sir Harry Ricardo, an English engineer, introduced high turbulence into combustion-chamber design by lowering part of the cylinder head (see Fig. 16) so that the piston closely approaches this

part at the top of its stroke. The charge is forced out of this thin space, greatly agitating the entire mixture and resulting in a faster, more complete combustion.

Most four-stroke-cycle compression-ignition engines have valve-in-head construction. The classification of these engines according to combustion-chamber design is based upon the method of controlling the combustion process, such as the open combustion chamber and the precombustion chamber. In the open combustion chamber

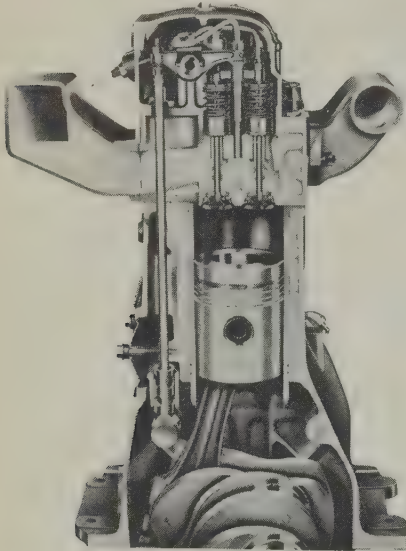


Fig. 17. Allis-Chalmers open-chamber, four-stroke diesel engine is rated at 340 bhp. (max.) at 1,800 rpm. It is used on boats, tractors, and industrial machinery.

the fuel is injected under high pressure directly into the clearance space or chamber between the piston and the cylinder head (see Fig. 17).

The piston head is usually shaped to fit the fuel spray, and air swirl moves the unsprayed

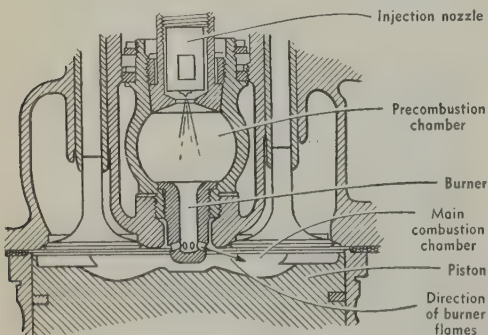


Fig. 18. Main combustion chamber and precombustion chamber of Mercedes-Benz diesel engine.

air into the fuel spray. Air swirl is accomplished by intake port design, by shrouding the intake valve, or in the two-stroke engine, by using tangential intake ports. The open chamber

gives highest efficiency and easiest cold starting with the lowest compression pressure.

The precombustion chamber is a small chamber located in the cylinder head and connected by a small passageway to the main part, in the cylinder (Fig. 18). The prechamber holds 30 per cent or less of the total combustion air. The fuel is injected into the small chamber, and except under light loads, partial combustion occurs and discharges the burning mixture into the main combustion space, creating turbulence, mixing the fuel and air, and producing vigorous burning. This type of combustion chamber produces a smooth combustion process, but it has fairly high fluid friction and heat transfer losses.

Ignition.—The type of ignition used on compression ignition engines depends on the degree of compression reached, as follows:

(1) Low-compression engines (6 to 10 compression ratio) require some external heat application to a tube, bulb, or plate, at least for starting (called surface ignition). After operating temperatures have been reached, a sufficiently high temperature is maintained at the tube, bulb, or plate to ignite the fuel.

(2) Medium-compression engines (10 to 14 compression ratio) require some form of ignition, such as an electric spark or electric hot wire, for starting. The spark is sometimes still used even after operating temperatures have been reached.

(3) The high-compression engine (14 to 16 compression ratio) is the true diesel. It uses a compression pressure of about 500 psi. It requires no means other than compression for igniting the fuel.

In the gasoline engine it is necessary to supply a spark to start the burning of the fuel-air mixture after it has been compressed by the upward stroke of the piston.

A spark plug (or sometimes two of them) fits into the wall of the combustion chamber. It has two wires or electrodes, which extend slightly into the chamber and are separated from each other by a narrow gap. High-voltage electricity is led to the spark plug so that it jumps the gap from one electrode to the other at the proper instant. This causes a spark, which starts combustion. Either a battery system or a magneto system may be used to supply the electricity to produce the spark.

A typical battery ignition system is shown diagrammatically in Fig. 19.

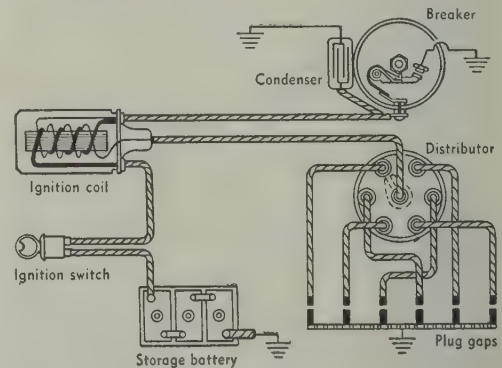


Fig. 19. Simplified battery ignition circuit diagram.

There are two circuits in the electrical system, that is, two complete paths around which the electricity flows. These are the primary or low-voltage circuit and the secondary or high-voltage circuit.

The low-voltage circuit (12 volts on passenger cars) is as follows: the current flows from the battery (one terminal of which is grounded to a metal part of the car) through the ammeter, ignition switch, the heavy or primary winding of the coil (several hundred turns of wire of comparatively large diameter) to the ignition points of the breaker. Here the circuit is completed by grounding. A condenser is also attached to the primary circuit, the other end being grounded.

The secondary circuit starts from ground in the secondary winding of the coil (which consists of 10,000 to 20,000 windings of fine wire) and passes through a heavily insulated wire into the center of the distributor cap. A contact carries the current to the rotor, which, as it revolves, distributes the current to the six segments (as shown in Fig. 19), which in turn send it to the spark plugs through the connecting wires. (About 10,000 volts is needed to make a spark jump a gap of 0.025 to 0.040 inch in an engine in operation.) After the current jumps the spark-plug gap, igniting the fuel mixture, it is grounded.

As long as an electric circuit is flowing steadily in the primary circuit, no current flows in the secondary. If that circuit is suddenly broken, however, a momentary high voltage is set up in the secondary circuit. This may be as much as 20,000 volts.

This operation is accomplished by means of the breaker in the primary circuit, which cuts this circuit often enough to send a high voltage to each spark plug each time it needs to be fired. It consists of a pair of contacts, which are opened and closed rapidly by a cam having as many points as there are cylinders. The cam is operated by the engine so that the contacts open near the top of the compression stroke of each piston. Thus, the primary circuit is continually being broken, thereby sending a series of high-voltage surges through the secondary circuit of the system.

A condenser is incorporated in the breaker case to help give a quick, clean electrical break and to get a good spark in the combustion chamber.

The function of the distributor is to get the high-voltage current generated in the secondary coil to the proper spark plug at the proper time.

A magneto ignition system has all the parts of the battery ignition system and, in addition, a generator for producing alternating current impulses directly in the primary winding of what is, in effect, a spark coil.

An advantage of the magneto is its self-contained character. All of the elements of the system are in one compact unit from which it is necessary only to run a low-voltage cable to the ignition switch on the dash, and high-voltage cables to the spark plugs.

Two electrical developments that look promising are transistorized ignition and the alternator for cars.

The successful application of the transistor as a solid electronics switch to ignition systems was announced by Electric Autolite in 1959. It is based on the transistor's ability to amplify current. It provides increased life for ignition contacts and improved output voltage. The system is being extensively field tested prior to its anticipated introduction into production vehicles.

The alternator was first offered by Chrysler

in 1960. Compared with the d-c generator, it is lighter, has longer life, and gives improved performance.

Compression Ratio.—When the piston is as close to the top of the cylinder as possible, that is, at top dead center, the small volume (which is the combustion space) is called the clearance volume. The volume of cylinder that the piston moves through is called the displacement. It depends on the bore (that is, the diameter of the cylinder) and the stroke (or the distance through which the piston moves). The compression ratio is defined as the piston displacement plus the clearance volume (which is the total volume when the piston is at bottom dead center) divided by the clearance volume. Higher compression ratios, within limits, result in increased thermal efficiency, which in turn provides improved engine performance. Thus, the higher horsepower of modern engines is due, in part, to their higher compression ratios.

At a particular compression ratio, the ideal Otto cycle is more efficient than the diesel. In actual practice, however, diesel engines are generally more efficient than Otto-cycle engines because the former can operate at higher compression ratios. If the compression ratio is too high (for a particular fuel) in an Otto engine, a phenomenon called detonation or knock will occur.

Detonation.—Briefly, detonation may be explained as follows: When the mixture is ignited, combustion starts at the spark and spreads through the combustion chamber behind what is called the flame front. As the temperature of the burned gases rises, they expand and compress the unburned gases. If the compression ratio of the engine is too high, the unburned gases are compressed to the point where they get so hot that spontaneous combustion begins at some point remote from the spark. There is a rapid increase in pressure at this point, which results in violent, vibrating pressure waves. The audible evidence is a metallic click or knock when these waves strike the wall of the combustion chamber. Excessive detonation is accompanied by severe pressures, which may eventually damage the engine. In addition there is a small loss of power when detonation occurs. However, since the engine is operating at close to maximum thermal efficiency when detonation is incipient, maximum efficiency is often obtained when there is a slight detonation or "ping."

It should be noted that compression ratio is not the sole determining factor affecting detonation. For this reason, such developments as the following have permitted compression ratios to be increased without detonation.

(1) Special substances (called antiknock agents), that can be added to a fuel to help it to resist detonation. These include tetraethyl lead, tetramethyl lead, and triptane.

(2) Redesign of the shape of the combustion chamber to reduce detonation.

(3) Increasing the rate at which heat is carried away from the combustion space by the use of thinner sections in the head, by the use of materials of higher heat conductivity, such as aluminum alloy and bronze for the head, and by improving the conductance of heat from the top of the piston.

(4) Reducing the number of local hot spots in the combustion space by better finishing, which removes small projections that may become red hot and cause spontaneous ignition, and by more efficient cooling of various parts near or in the combustion chamber, such as the spark plug and the valve seats.

Octane Rating.—The antiknock properties of gasoline are measured by a concept called oc-

tane number; the higher the octane number, the less the tendency of a gasoline to knock. The octane rating of a fuel is obtained by supplying the fuel to a standard test engine and comparing its knocking property with that of a reference fuel of known octane number. The reference fuel is a mixture of isooctane (which has high antiknock properties) and heptane (which has very poor antiknock qualities). If a fuel being tested has the same knocking characteristics as, for example, a mixture of 70 per cent isooctane and 30 per cent heptane, it is said to have an octane number of 70. By this method of rating, pure isooctane would have a rating of 100.

Fuels have been developed with better knocking properties than isooctane and therefore with antiknock ratings of greater than 100. These fuels, which are particularly for aircraft use, are rated by a system called performance number. For example, the performance number of triptane plus 4 cc. tetraethyl lead per gallon is 360. This means that in a supercharged engine it is capable of giving 3.6 times as much power as isooctane.

Cetane Number.—Analogous to octane number for gasoline is the cetane number of fuel oils. This number is a measure of the speed with which the fuel ignites, that is, the time lag between the beginning of injection and the rapid pressure rise due to combustion. If the cetane number of a fuel is too low for a particular engine, rough running will result, especially at high speeds. Fuels of high cetane number give smooth combustion and provide easy starting. The lower the engine speed, the less important the cetane number.

Cetane is a fuel with a high ignitability. It is mixed with alpha-methylnaphthalene, which has a low ignitability, to form a reference fuel. If the fuel being tested has the same ignitability (measured by the ignition lag) as a mixture of, for example, 60 per cent cetane and 40 per cent alpha-methylnaphthalene, it is said to have a cetane number of 60.

In general, cetane numbers of fuel oils range from 30 for large, slow diesel engines to as high as 60 for high-speed engines.

Corresponding to antiknock agents for gasoline there are certain ignition accelerators that may be added to diesel fuels in the proportions of 1 to 5 per cent. These substances, such as ethyl nitrate and amyl nitrate, reduce the delay period and so tend to reduce "diesel knock." Unfortunately, they also add to the cost.

Supercharging.—Supercharging is often used to retain the sea-level power (or as close to it as practicable) of piston engines operating at altitude. It is also used, in certain cases, to increase the output of land and marine engines, especially diesels.

Quite simply, supercharging is a method of increasing the density of the air supplied to the engine by some sort of compressor. In other words, by compressing the air to a density greater than atmospheric, we are able to get more of it into the cylinders, thus providing greater power without increasing the size of the engine and without having to run it at undesirably high speeds.

The supercharger consists of an air compressor and some means of driving it. The compressor may be of any type—reciprocating, rotary, positive displacement, centrifugal, or axial flow.

Supercharging is particularly important for aircraft piston engines because (1) at high al-

titudes the power of an unsupercharged engine falls off drastically (for example, an unsupercharged engine of 1,000 hp. at sea level would produce only 500 hp. at 18,000 feet), and (2) it is possible to produce a marked improvement in sea-level performance of an engine without seriously affecting its life or dependability.

Usually, exhaust-driven centrifugal units, called turbochargers, are used because they utilize part of the exhaust energy, which would otherwise be wasted.

Except for high-speed engines, such as are used on racing cars, supercharging is not common on automobiles because, if the engine is already operating at optimum compression ratio with the available fuel, the addition of supercharging would cause detonation. To eliminate the detonation it would be necessary to lower the compression ratio, enrich the mixture, or increase the octane number of the fuel.

Supercharging has entirely different aspects when applied to diesel engines, where it tends to suppress rather than promote knock. For this reason, supercharging of diesels is much more common.

Probably the most used methods of supercharging diesels are by means of the Roots-type blower and the turbocharger.

The Roots blower (Fig. 20) consists of two rotors inside a housing. Each rotor has two, three, or four lobes, which fit together like gear teeth as the two rotors are driven from the engine crankshaft. Air is drawn in and carried around the outer side of the rotors to the outlet and into an air chamber which entirely surrounds the lower part of the cylinders. This compartment of air under pressure is fed to the cylinders.

Although these blowers are somewhat expensive to build, they have been very popular because they give trouble-free service for long periods and, except for a characteristic whine at highest speeds, are quiet running.

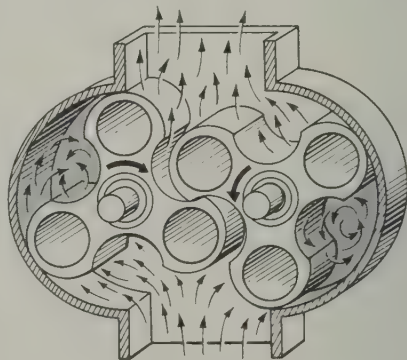


Fig. 20. Roots blower.

The turbocharger (Fig. 21) is inexpensive and requires no attention beyond bearing lubrication. As with the aircraft type, an exhaust gas-driven turbine drives the compressor that supplies the air to the engine.

Valves and Mechanism.—In the operation of the internal combustion engine a fresh charge of air, or mixture of fuel and air (depending on whether it is a diesel or Otto engine), must flow into, and be trapped in, the cylinder at the proper

time during each cycle. A short time later the products of combustion must be allowed to flow out of the cylinder. On two-stroke engines, this is frequently accomplished with ports (see Fig. 11), but on four-stroke engines, and also on many two-stroke units, valves are used.

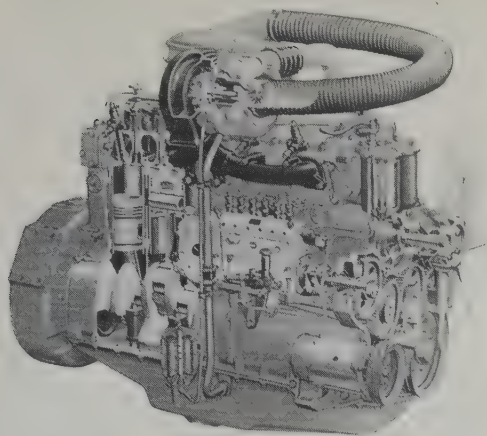


Fig. 21. Scania-Vabis six-cylinder diesel engine with turbocharger.

The first requisite of valves is that they allow the engine to breathe freely, that is, the resistance to flow through the valve opening should be minimum so that there is little difference in pressure between the cylinder and the surrounding atmosphere. When the valves are closed they must seal the combustion space tightly, or loss of compression will result.

The mechanism must open and close the valve at the proper times as well as giving it the desired lift. The demand for quiet operation has brought forth designs that seat the valves with practically no noise.

The most common valve is the poppet, which consists of a head and stem. The head was originally a flat disk to which the stem was attached. A more modern version is the tulip valve, which makes possible good streamlining of the head into the stem without adding excessive weight. Hollow valve stems are used to reduce weight. The hollow stem is sometimes filled with sodium (which melts at valve-stem temperatures and is an excellent conductor) so that it carries the heat from the head along the valve stem.

Sleeve Valves.—The double-sleeve valve was invented by Charles Y. Knight in 1905. He applied it to an engine that was called the "silent Knight" because its operation was so quiet, due to the reduction in valve noises. Chief disadvantage was the difficulty in providing satisfactory lubrication. Failures in lubrication occasionally caused the sleeves to stick, which often wrecked the engine.

The valve consists of two concentric sleeves (Fig. 22) located between the piston and the cylinder wall. The sleeves are driven by an eccentric shaft operated at half speed. Ports in the two sleeves and in the cylinder wall form the intake and exhaust openings. The upper ends of the sleeves slide back and forth between the cylinder head and the wall.

In 1910 Peter Burt patented a single-sleeve-valve engine. He was able to use a single-sleeve valve to open and close both intake and exhaust ports by giving it a combination of two motions, that of vertical reciprocating and angular oscillation.

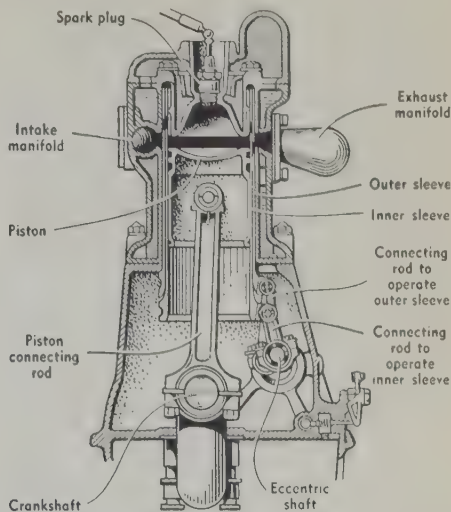


Fig. 22. Section through cylinder and sleeves of Willlys-Knight engine.

Manifolds.—**Intake.**—The intake manifold provides the passage for the air and fuel mixture (or air alone, in the case of the diesel) to travel to the intake ports or valves of the cylinders.

An ideal manifold for a gasoline engine would supply an equal charge of identical fuel/air ratio to all the cylinders at all speeds, loads, and rates of acceleration.

In actual practice, something less than this is attained, for various reasons. For one thing, less than half the gasoline is actually vaporized by the carburetor, the rest being in the form of fuel particles ranging from a fine mist to particles of appreciable size. Thus, a manifold that distributes the air equally among the various cylinders will not necessarily distribute the fuel equally, for the inertia effect of the fuel particles is considerably greater than that of air molecules.

To get the fuel properly vaporized, heat from the exhaust gases is supplied by one of the following methods:

- (1) By preheating the air before it enters the carburetor.
- (2) By surrounding the "T" of the manifold with an exhaust jacket.
- (3) By heating that portion of its wall where any unvaporized fuel collects.

The first method was used for a good many years, but it has now been discarded in favor of the other two, which have a less detrimental effect on engine power.

A thermostat is generally used to shut off the heat automatically when the engine warms up.

Exhaust.—The exhaust manifold collects the gases from the exhaust openings of the various cylinders and conducts them to a central exhaust passage. It is designed to avoid as much as possible the overlapping of exhaust strokes. This is often done by dividing the manifold into two or more branches so that no two cylinders will

exhaust into the same branch at the same time.

Cooling.—All internal combustion engines require some means of cooling. Very roughly, one third of the energy of the fuel is transformed into mechanical energy and one third is removed with the exhaust gases. The remaining third must be transferred through the cylinder walls and head and carried off by some cooling medium circulating over the exterior surfaces.

Air cooling has been most popular in the aircraft and motorcycle fields. It was much used when the automobile industry was in its infancy, but then it lost its popularity. For many years, no American car was air cooled, although a number of European ones were—a notable example being the Volkswagen engine. Then Chevrolet reintroduced the idea in America with its 1960 Corvair.

When air is used as the coolant, the outer surfaces of the cylinders and heads are cast with fins and flanges to give more heat-dissipating surface (see Fig. 5).

With liquid cooling, the cylinders and heads are jacketed by casting them with cored passages through which the cooling liquid is circulated.

The circulation of the liquid may be by thermosiphon effort or pump.

The thermosiphon principle, used only on a few tractors and road vehicles, depends on the fact that heated water expands and therefore tends to rise. The cooling system is so arranged that this tendency is used to effect the circulation of the water through the system.

Generally, the circulation of the cooling water or other liquid is accomplished in more positive fashion by means of a small centrifugal pump.

For stationary and marine applications where an abundance of cooling water is available, the heated water is wasted and replaced by cold water. On vehicles and liquid-cooled aircraft engines, however, the water is used repeatedly, being cooled between its courses through the jackets in an air-cooled radiator that forms part of the cooling system.

In addition to a pump, most modern liquid-cooled systems employ a thermostat, which prevents the water in the engine jacket from circulating through the radiator until its temperature has reached a point suitable for efficient engine operation.

Because the temperature of a cooling system open to the atmosphere is limited by the boiling point of its liquid (212° F. for water and considerably lower if an alcohol is used as the antifreeze), pressure systems have been devised. A special pressure cap, designed to relieve the pressure when it reaches the value for which it has been set, must be used. It must also relieve the vacuum that forms in the system when the steam therein condenses after the engine has been shut down.

Evaporative cooling systems employing a hopper are often used on small stationary engines. The hopper is a large open water tank to which make-up water is added as evaporation takes place. Other evaporative systems employ a radiator, which is not open to the atmosphere, but becomes a condenser of steam. The condensate can then be pumped into the water jacket.

Lubrication.—The distribution of oil to the bearings in an engine can be accomplished in several ways. In early engines, and even now in some stationary engines, oil is fed to each bearing from an individual supply. Usually a

gravity sight-feed oiler is used for each cylinder, main bearing, and crankpin bearing, which makes use of a "wiper" action to get the oil from the oiler outlet.

Next came the mechanical oiler, which delivers the oil under pressure from a common supply to each bearing by means of individual plungers and oil lines. The quantity for each bearing is metered according to the need for lubricant. Some bearings on large stationary engines are oiled with ring oilers, which dip into a small sump and carry the oil up to the shaft.

The automotive engine usually has a self-contained oiling system in which the oil is continuously recirculated. The lower part of the crankcase provides the sump or reservoir for the oil supply. There are several systems for supplying the oil to the moving surfaces.

In the splash system the lower ends of the connecting rods have dippers, which travel through oil troughs at the bottom of the stroke and splash the oil over the lower cylinder surfaces as well as the crankcase surfaces. The piston spreads the oil over the upper cylinder surfaces while ducts or channels lead the oil to the crankshaft and camshaft bearings. The lower connecting-rod bearings have oil forced in through an oil hole in the lower half during the time the rod dips into the oil. The main disadvantage of this system is the lack of positive circulation to the bearings, which limits the bearing loading and quantity of oil circulated. Also, the bearings are not cooled appreciably by the oil.

Actually, the splash system is almost nonexistent today, having been replaced by the fully pressurized oil system. Frequently, it is also equipped with full-flow oil filters as shown in Fig. 23.

Airplane engines must operate satisfactorily in any position. For this reason they generally use what is called the dry-sump system. That is, very little oil is retained in the crankcase sump. The oil is scavenged by a pump and delivered to a main oil tank placed in any convenient position. This necessitates the use of at least two pumps: one for scavenging the crankcase and the other for feeding the oil back to the main bearings and other parts of the engine.

There are three ways in which oil can be consumed in an engine in good condition:

- (1) Burned in the combustion chamber.
- (2) Leakage where the crankshaft or other shafts protrude from the crankcase.
- (3) Loss of oil mist or vapor from the breather.

Engine speed is the most important factor affecting oil consumption. As engine speed increases the oil temperature rises, reducing the oil viscosity. This causes more oil to flow through the crankpin bearings, which in turn causes more oil to be sprayed on the cylinder walls. At high speeds the rings do not follow the cylinder wall as closely as at low speeds. They tend to act something like surfboards, riding on the film of oil. Under this condition more oil is passed to the combustion chamber instead of being scraped back into the crankcase.

Higher speeds also cause more wear of moving parts, which then have larger clearances for oil to flow out.

In general, the condition of the cylinder bores, pistons, rings, and the various clearances between these parts have more to do with oil consumption than do the characteristics of the lubricant used.

The development of oil control rings has done more to control the oil passed to the combustion chamber than any other factor. However, a good oil control ring that gives satisfactory oil consumption at high speeds is apt to cause insufficient lubrication and excessive wear at low speeds. The best compromise seems to be excessive oil consumption at high speeds.

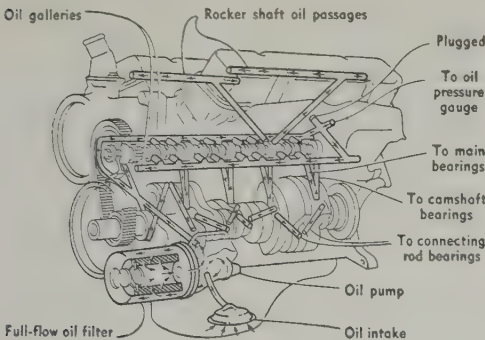


Fig. 23. Lubricating system for Chrysler Corporation V-8 engine. The oil pump draws the oil from the sump through a fixed screen suction pipe and forces it through the full-flow oil filter. From there it flows to the various parts of the engine.

In some small two-stroke engines, as used in marine service, the lubricating oil is mixed with the fuel and fed directly to the cylinder walls where the gasoline evaporates from it into the combustion space.

Engine Vibration and Mechanical Balance.—In general, there are two forms of motion in a reciprocating engine that may give rise to vibration: rotary and reciprocating. Mechanical balance of an engine is attained when the moving parts (both rotating and reciprocating) are arranged so that they counterbalance in operation, thereby minimizing vibration.

Rotating parts are balanced mechanically by bringing them into static and dynamic balance. A rotating part is in static balance if, when its bearing sections are placed on parallel knife edges, set in a horizontal plane, the part remains in any position to which it is rotated. Such a part is not necessarily in running or dynamic balance. That is, it is possible to have the center of gravity of the part lie on its axis of rotation (thus giving static balance) and still not have the weight balanced along the axis, so that the part wobbles endwise when it is rotated at high speed. The crankshaft and flywheel are the principal rotating parts to be balanced mechanically.

Bringing the reciprocating parts into mechanical balance is much more complicated than for rotating parts. The weight of the piston and connecting rods moving one way and then the other produces considerable vibration. The crankshaft is subject to shocks in bringing these parts to a stop at each end of each stroke. These shocks are called "primary inertia forces." They are increased in intensity by the gas pressure on the piston at the end of the cycle.

In a well-built engine, all pistons and all connecting rods are the same weight within close limits, and the flywheel and crankshaft assembly is balanced dynamically. By such practices much of the vibration is minimized.

There are, however, certain types of vibration that still must be eliminated or at least minimized in every engine. For instance, there is torsional vibration of the crankshaft, which is caused by a slight winding and unwinding of the crankshaft resulting from the application and release of the power impulses on the crank throws of the crankshaft.

A number of methods are used to minimize torsional vibration. One is to design the crankshaft so that its basic or highest critical speed is above the maximum speed of the engine, and to damp out the torsional vibration that occurs at lower speeds by special means or by natural bearing friction. Most six- and eight-cylinder automotive engines depend on torsional vibration dampers because of the relatively long crankshafts and high speeds of these engines. One type, called a "harmonic balancer," is provided with an inertial weight that is set in motion by the torsional vibration but, because its motion is out of phase with or opposed to that of the crankshaft, it tends to neutralize the vibration of the crankshaft or damp it out.

Power and Its Measurement.—Engines of all kinds are rated in horsepower, which is a measure of the rate at which they can work. The term horsepower is used in different ways, for instance: (1) Indicated horsepower is the power developed inside the cylinder by the expansion of the gases. It can be obtained by measuring the area of the indicator card. (2) Brake horsepower is the power the engine actually delivers. It can be measured by means of such equipment as the Prony brake, fluid friction dynamometer, electrical dynamometer, and the transmission dynamometer.

The difference between the indicated horsepower and the brake horsepower is called the friction horsepower. It represents the horsepower lost because of the friction of the moving parts.

There is another commonly used—if more or less fictitious—horsepower called the AMA rating (known in England as the RAC rating and often erroneously called the SAE horsepower). For years it was widely used for taxation purposes, although the practice is dying out. The formula for calculating this horsepower is $D^2N/2.5$, where D is the diameter or bore of the cylinder in inches and N is the number of cylinders. This simplified formula is based on three assumptions: (1) a mean effective pressure of 90 psi.; (2) a mechanical efficiency of 75 per cent; (3) a piston speed of 1,000 feet per minute.

At the time when the Royal Automobile Club of England developed this formula, it represented fair average values for automobile engines, but in modern engines they are very much exceeded. As a result, a good modern engine may actually develop a brake horsepower of three or more times its AMA rating.

Efficiencies and Their Measurement.—The engineer uses various types of efficiency to describe how well his engine is operating. For instance, he uses the expression "thermal efficiency," which is simply output divided by input. If the output is the net work as obtained from an indicator diagram and the input is the energy contained in the fuel, the ratio is the indicated thermal efficiency. If the output is the brake work, as measured, for example, by a Prony brake, then the brake thermal efficiency is obtained.

Also of great importance is the mechanical

efficiency, which is the brake horsepower divided by the indicated horsepower.

Friction horsepower is determined by driving the engine with the dynamometer and noting the consumption of power. Thus, this power includes that necessary to pump the gases into and out of the cylinders. It goes up rapidly at high speeds. At maximum speed, it may be about half the brake output of the engine.

It is to be noted that mechanical efficiency drops off as speed increases. This is due to the rise in friction horsepower at the higher speeds.

Since the fuel consumption is related directly to the brake thermal efficiency, as the curve for brake thermal efficiency rises the fuel consumption decreases. Over a fairly wide range both these curves should vary little. At very high speeds, however, the brake thermal efficiency drops off rapidly, causing the fuel consumption to rise steeply. Thus, not only does the power necessary to drive a car at high speeds increase very rapidly (about as the cube of the speed), but the efficiency of the engine falls off.

Torque is significant for an automobile engine because the acceleration or pickup of the car depends on the available torque, which is the maximum possible torque at a given speed minus the torque being developed to maintain the speed constant. A high torque at low speeds indicates ability to pick up a heavy starting load.

Mean effective pressure (often abbreviated to mep.) is the average net pressure acting on the piston for the stroke that does the same work as represented by the indicator card. It measures the relative power per cubic inch of displacement. The higher the mep., the greater are the power and work obtained from a cylinder of a given size; therefore, for economy in the use of materials, the mep. should be high. The indicated mep. can be determined by measuring the area of an actual indicator card. The brake mep. at any speed can be obtained from the formula:

$$\text{Brake mep.} = \frac{792,000 \times \text{bhp.}}{D \times N}$$

where:

bhp. = brake horsepower of the engine at N
 D = piston displacement, cubic inches
 N = engine speed, rpm.

Gas Engines.—There are two general types of gases used as the fuel in gas engines:

- (1) Those that become liquid with the application of only a moderate degree of pressure.
- (2) Those that remain gases until compressed under very high pressures at very low temperatures.

The first classification includes such fuels as propane and butane, which are designated liquefied petroleum gases (LPG).

LPG is used to some extent as a fuel for trucks and buses. If it is used in engines designed to burn gasoline, certain changes must be made, such as the use of a pressurized fuel tank, the addition of a converter (which is a combination pressure regulator and vaporizer), and a special carburetor.

The use of LPG as a fuel for automotive vehicles is limited, however, by several factors, such as the high degree of explosiveness of the fuel (it is more easily exploded than gasoline), the need for engines of high compression ratio to take advantage of the high antiknock rating of the fuel, and its relatively high cost.

Purely gaseous fuels are used only in sta-

tionary engines because the engine must be near its fuel source. It is impossible to carry even highly compressed gases in a quantity great enough to permit any considerable range of action to a vehicle.

Gas is used as a fuel only when there are available cheap natural or byproduct gases in adequate quantities. Thus, outside the natural-gas regions, the most extensive application is in connection with blast furnace plants, in which large quantities of combustible gases are produced as a byproduct. Here they can be used to operate blowing engines that furnish air to the furnaces and to drive generators to supply electricity for the plant and neighboring communities.

Most gas engines operate on the Otto cycle, although dual-fuel engines have also been built that operate on the diesel cycle and run on either gas or fuel oil. Another variation is the gas-diesel engine in which a small quantity of fuel oil is introduced at the same time as the gas is injected into the cylinder.

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INTERNAL REVENUE, în-tîr'năl rěv'-ě-nŭ, a system of domestic taxation by national governments. Since the beginning of the 20th century, it has accounted for the largest share of national governmental revenues in the major economies of the world. In Great Britain and many present or former British dominions—such as South Africa, Australia, and New Zealand—the system is called inland revenue. In the United States, Canada, and most of Europe, internal revenue is the term. The basic composition is the same under either name, although individual taxes vary in name and importance from nation to nation.

Internal revenue is distinguished from customs on the one hand, and from "miscellaneous receipts" on the other. Customs or duties are ad valorem taxes levied on foreign trade, almost always on imports. "Miscellaneous" or "other receipts" represent a catchall group of revenue sources, ranging from the sale of public lands to the income of government-owned corporations.

Internal revenue (or inland revenue), then, consists of the system of taxes levied by the national or federal government on trade, property, and income existing within the national boundaries. State and local revenues are not included in the concept of internal revenue. Taxes levied by state and local governments are internal to the national economy. Since the states levy no customs duties, there is no necessity to distinguish their internal revenue.

Historical Background.—Internal revenue taxes, particularly property taxes, are as old as recorded financial history. Until the commercial revolution of the 13th and 14th centuries, however, foreign trade did not produce a very substantial share of national revenues. The development of international trade, particularly in western Europe and the Near East, changed all this. At the same time, then-current economic and political philosophy dictated the emergence of

protectionism. Customs duties were imposed partly to discourage the importation of foreign goods, and partly to raise revenues. As has happened so often with sumptuary taxes, customs duties failed to discourage international trade to any substantial extent, but they did raise revenues. The discouragement was so slight, in fact, that by the 18th century customs duties provided the bulk of national revenues in the Western World.

Great Britain.—In Great Britain in the 18th century, the principal sources of inland revenue were excise and stamp taxes. By 1800, death duties in the form of stamps required for documents and of estate taxes, had been incorporated into the inland revenue system, along with income taxes. The formal organization of the system occurred in 1849, when the Board of Inland Revenue was created. The board has unified jurisdiction over excises, stamps, death duties, and income and profits taxes.

The organization of the inland revenue system coincided with the decrease in importance of customs duties. Great Britain became formally and completely committed to free trade in 1860. At that time, a tradition of relatively heavy "outlay" or excise taxes on a limited group of commodities was established. That tradition has been carried through to the post-World War II period. Land and real estate taxes are part of the "local rate" and therefore excluded from the inland revenue total. The largest single share of the British inland revenue has been produced by income and profits taxes since 1930, but such taxes have not assumed the same relative importance as income taxes in the United States.

United States.—The internal revenue system of the United States has been under the jurisdiction of the Treasury Department since its inception in 1789. During the early years of the republic, however, internal revenue accounted for a very small percentage of total federal revenues indeed. As in Great Britain, the overwhelming majority of revenues came from customs duties. The accompanying table shows that internal revenue did not pass customs duties as a source of federal revenue until the beginning of the 20th century. Emergency taxation during and immediately following the Civil War raised internal revenue above customs receipts in the 1861-1870 period but this was a temporary condition stemming from war financing.

UNITED STATES GOVERNMENT RECEIPTS
Selected Years 1800-1960
(millions of dollars)

Year	Customs	Internal revenue	Other revenue	Total
1800	5.0	0.4	0.3	5.7
1825	16.4	1.5	2.1	21.0
1850	25.6	¹	2.9	28.5
1875	186.2	120.0	30.6	336.8
1900	185.1	206.6	43.2	434.9
1925	464.0	3,163.7	679.0	4,306.7
1950	431.7	40,259.8	3,094.4	43,785.9
1960	1,104.9	76,658.2	17,367.1	95,078.2

¹ Less than \$50,000.

Source: United States Treasury Department.

The first internal revenue taxes levied in the new United States included an excise tax on whiskey and other domestic distilled spirits, and an excise tax on carriages. The liquor tax created a considerable amount of indignation, particularly among the rum distillers of Massa-

chusetts and the whiskey producers in the Allegheny and Cumberland mountain regions. The indignation culminated in 1791 in the Whiskey Rebellion (q.v.) which was not quelled until 1794.

The carriage tax in turn led to the Supreme Court case of *Hylton v. United States* (3 Dallas, 171) in 1796. The point at issue was whether the tax was direct. If it was, then it could be levied only according to the rule of federal apportionment as prescribed by the Constitution. The court, however, gave a very broad construction of "indirect taxes." It ruled, in effect, that the direct taxes contemplated in the Constitution were but two: a capitation or poll tax; and a tax on land. In the United States these taxes are reserved to the states. The right to levy a land or real property tax is generally delegated by the states to local governments. Neither tax is part of the internal revenue system, therefore.

Between 1794 and 1800, additional excises were levied. They included a liquor retail license fee, and taxes on snuff, sugar, and auction sales. In addition, duties were placed upon legal transactions in the form of stamps to be affixed to the legal documents. Direct taxes were attempted in 1798, with levies on dwellings, lands, and slaves. The results were so indifferent and collections so slow that the attempt was abandoned in 1801. Internal revenue levies were then reduced until 1804, when they were eliminated entirely. They were all re-established in 1814, under the impact of the War of 1812. The volume of revenues, however, declined quickly and sharply, and remained at quite low levels until the outbreak of the Civil War in 1861.

The burden of war financing called forth a whole variety of internal revenue tax measures in 1862. It was noted above that in Great Britain relatively high levies have been placed upon a small number of items. The philosophy of the United States excise and income levies of 1862, on the other hand, was the imposition of moderate duties upon a wide range of items. The contemporary view of David A. Wells aptly described the measure: "Wherever you find an article, a product, a trade, a profession, or a source of income, tax it."

It was after the enactment of this catchall measure that internal revenue briefly exceeded customs duties as a source of federal revenues. Between 1866 and 1870, however, various levies were repealed so that only the excises on spirits and tobacco, stamps on documents, taxes on banks and bankers, modest duties on manufactures, and the income tax remained in the internal revenue system. The income tax expired in 1872. The system then remained stable until 1883. It should be noted that after 1865 internal revenue taxes were repealed in nearly as haphazard a way as they were originally enacted.

In 1883, the stamp duties and the tax on banks and bankers were repealed, leaving only the sumptuary taxes on tobacco and liquor in the internal revenue system. A tax on oleomargarine was enacted in 1887. Inheritance taxes, and stamp and business taxes were instituted in 1898 to help pay for the Spanish-American War.

Income Tax.—The income tax was dealt a serious blow in 1895 when it was declared unconstitutional by the Supreme Court in *Pollack v. Farmers' Loan and Trust Co.* (157 U.S. 429; 158 U.S. 601). This reversed the 1880 decision of *Springer v. United States* which upheld the Civil War income tax. Nevertheless, a corporate in-

come tax was included in the Payne-Aldrich Tariff Act of 1909. It was upheld by the Supreme Court, and has remained an integral part of the United States internal revenue system ever since.

In 1913, the 16th Amendment to the Constitution was ratified, making the income tax constitutional (see *INCOME TAX*). The personal income tax was included in the Underwood Act of 1913. It, too, has remained in the internal revenue system to become the largest single source of internal revenue in the United States.

The advent of social insurance in the 1930's added the Railroad Retirement and Social Security (Payroll) taxes to the internal revenue system. An undistributed profits tax in 1939-1940, and the World War II excess profits tax have since been added to and removed from the tax rolls. The United States internal revenue system is now codified in the Internal Revenue Code of 1954, a complete revision of the American tax structure. It is based largely on the 1939 code, with extensive streamlining and modernization.

Summary.—The United States internal revenue system consists of a few major groups of taxes, as indicated in the following table, which shows their relative importance in comparison with their role in the United Kingdom's inland revenue system.

PERCENTAGE DISTRIBUTION OF INTERNAL
REVENUE RECEIPTS
(1960)

Tax source	United States	Great Britain
Income and profit taxes	70	45
Corporate income	(24)	(22)
Individual income	(46)	(23)
Employment taxes	13	11
Alcohol taxes	4	10
Tobacco taxes	2	15
Estate and gift taxes	2	4
Manufacturers excise taxes	3 }	
All other	4 }	15

The table points up the major difference between the American and British internal revenue (inland revenue) systems. While heavy reliance is placed upon income taxes in the United States, the British depend much more upon excises, or "outlay taxes."

See also *EXCISE*; *INCOME TAX*; *TAXATION*.

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INTERNATIONAL, ĭn-tĕr-nāsh'ŭn-āl or **INTERNATIONALE**, ăn-tĕr-nā-syô-nāl', the name given to the successive labor organizations which originated as the famous International Association of Workingmen. In 1836, a number of German exiles at Paris banded themselves together as a secret society, The League of the Just, with communistic principles. The group of exiles communicated with Karl Marx, and in 1847 held a congress in London where they reorganized and adopted the name of the Communist League. Its leaders commissioned Marx and Friedrich Engels to expound the principles of the

league in the *Communist Manifesto* (q.v.) which appeared shortly before the "February Revolution" of 1848.

In May 1849, Marx, who had been acquitted of high treason and expelled from Prussia, after a brief sojourn in Paris moved to London and settled there for the rest of his life. The league split in 1850 and ceased to exist.

First International.—It was the second International Exhibition of London in 1862 which furnished the occasion, curiously enough, for the founding of the International Association of Workingmen. Besides businessmen from all parts of Europe, a large number of foreign workers, artisans, and craftsmen, were assembled in London in 1862. A number of socialist and labor leaders saw this occasion as an opportunity for the creation of a labor international. Their hopes were realized, and two years later, on Sept. 28, 1864, a great meeting of workmen of all nations was held at St. Martin's Hall, London, under the presidency of Edward Spenser Beesly, the English historian and positivist. Marx was the chief inspirer of the movement; he was assisted by the secretary of Giuseppe Mazzini, Major Wolff—a circumstance from which arose the statement that Mazzini was the founder of the International. As a matter of fact, Mazzini mistrusted the whole affair and soon withdrew from it. A provisional committee was appointed to draw up the statutes of the association; these were to be submitted to a universal congress proposed to be held the next year at Brussels. There were 50 delegates in the committee, in which England, France, Germany, Switzerland, Italy, Poland, and other countries were represented. There was no secrecy about their procedure; it was by the widest publicity that they hoped to spread their propaganda, the dissemination of which was arranged in London.

Thus was born the International Workingmen's Association. Its program was expressed in the "Inaugural Address." To acquire political power, the workers of each country must first of all unite, "take an interest in international politics, watch the diplomacy of their governments closely, and uphold the simple rules of morality in the relations of private persons and of nations." The first congress was not held until 1866, at Geneva; after the second congress at Lausanne in 1867, it spread rapidly and acquired an influence which alarmed the French government. The third congress was convened at Brussels in 1868 and the fourth at Basel, Switzerland, in 1869. On the last of these occasions a number of anarchists attended, headed by the Russian Mikhail A. Bakunin (q.v.).

The International was at the zenith of its power in 1870. In 1872, its congress at The Hague became a battlefield of clashing factions and conflicting ideas. The followers of Marx, with their belief in the necessity of organizing a struggle for political power, clashed with the supporters of Bakunin, who feared centralized power and favored the decentralized and autonomous producers' cooperatives as the economic unit. The Marxists succeeded in transferring the seat of the General Council from London to New York, but the vitality of the International was spent. The final congress of the First International was held at Philadelphia in 1874.

Second International.—The international movement among workers fell into abeyance from the early 1870's until 1889, in which year

the Second International was born at Paris, and its headquarters established in Brussels in 1890. The principal force in the new movement was the German-Social Democratic Party. Almost entirely political in character—as distinct from the economic aspect—it demanded the abolition of standing armies and the creation of international arbitration tribunals. These demands were reaffirmed in Brussels in 1891, at London in 1896, and at Paris in 1900. At the last-named congress Jean Jaurès declared that the organization of international peace and brotherhood was the most important question before the gathering.

The Second International met again in 1904 at Amsterdam during the Russo-Japanese War, when fraternal greetings were sent to the proletariat of both countries and the Socialists and workers of all lands were called upon to oppose with all their might the continuance of war.

Stuttgart was the scene of the next International congress in 1907, when the question of wars and their prevention was again discussed. A resolution was finally passed in which war in general was attributed to competition from markets, militarism, national prejudices, and the desire to weaken the growing power of the working class. Gustav Hervé vigorously advocated a general strike as the most effective weapon to prevent the outbreak of war. A similar measure had been adopted in a resolution by the French Socialist congress earlier in the same year; the Stuttgart assembly, however, being strongly German in element, reflected the German fear of the disrupting influence of the general strike plank, and it was finally resolved that the general strike might be used as a *possible* method of averting war, though not an indispensable one. Militarism again loomed large at the next congress in Copenhagen in 1910. The Stuttgart program was revived and the congress again demanded the Socialist representatives should refuse the means for armament and advocated disarmament, arbitration of international disputes, the abolition of secret diplomacy, and a guarantee of all nations against military attack or suppression by force. A special congress of the Second International was convened at Basel on Nov. 24-25, 1912 to discuss the Balkan situation which threatened to set Europe in flames. This was the last meeting before World War I; in it the working classes of all lands were again urged to use the means which promised to be most efficacious in preventing war, and, in the event of war, to exert themselves to the uttermost to bring it to a speedy conclusion. With prophetic vision the congress declared that if the Balkan imbroglio were allowed to spread, it "would become the most frightful danger to civilization and the workers."

In the light of what was destined to happen only 20 months later—in July 1914—it is interesting to record the solemn admonition of the Basel congress to the Socialists of Austria-Hungary and environs: they were urged "to prevent any attack of the Austrian Monarchy upon Serbia." As all the world now knows, it was exactly an attack upon Serbia which precipitated World War I. The Second International was revived after that conflict ended, supporting socialism throughout the world but excluding Communists from its ranks. With headquarters in London, it adopted the statutes of the Labor and Socialist International (L.S.I.) which sought to attain its objectives by reason rather than by force.

Third International.—Meanwhile, the Third, or Communist International (known generally by the abbreviated "Comintern") was born in Moscow, March 2-6, 1919. From the beginning it was dominated by the Soviet Communist Party and eventually became in fact an arm of Soviet foreign revolutionary policy.

At the congress held in 1922, the Comintern was declared by its spokesmen to be "the revolutionary international of the working classes," and it boldly proclaimed that it stood "squarely for the overthrow of capitalism and the establishment of the workers' and farmers' government throughout the world." It advocated the Soviet form of organization and the dictatorship of the proletariat. The Comintern differed from its predecessors. Instead of an international of autonomous national parties, the Comintern was based upon the view that policies had to be accepted by the national parties and upon the principle of iron discipline and the subordination of national communist parties and their members to the decisions of the governing group in the International. Individuals and groups who refused to accept the dicta from above were ruthlessly purged from the ranks. The seventh and last congress was held in 1935. On May 15, 1943, in the midst of World War II, the executive committee of the Comintern announced its dissolution, and Communist parties in all countries were asked to ratify this step. In 1947 a new International Communist organization was created under the designation of Communist Information Bureau, popularly known as Cominform (q.v.).

The Cominform sought to unify the policies of the Communist parties of different countries, and was the method by which the subordinate parties were controlled. After the death of Joseph Stalin, the Cominform was dissolved (in April 1956) as a gesture of appeasement to Marshal Tito who had been an object of attack as a result of his break with Stalin.

An International Communist Conference was held in Moscow in the fall of 1960, and 81 parties were represented at this secret gathering of top Communist leaders. Twelve were parties in charge of the government of their countries, and the remainder were operating outside of the Iron Curtain. Representatives of all parties present signed the "Peace Manifesto," which bitterly assailed the Western countries, especially the United States. While the doctrine of "co-existence" was proclaimed, the class struggle was not renounced. In fact, the statement emphasized that under conditions of peaceful coexistence favorable opportunities for subversion of friendly countries will inevitably arise. This type of activity is referred to as "the development of the class struggle in the capitalist countries and... intensification of the struggle of the working class." The declaration attacked the West German government and called for opposition to it and support for the communist German Democratic Republic of East Germany.

Labor and Socialist Internationals.—The revived Labor and Socialist International was mainly composed of European Socialist parties which eschewed the use of violence and force for the achievement of political purposes, instead depending upon persuasion and parliamentary means to attain their objectives. The spread of fascism after 1931 gradually undermined these European parties, so that after 1931, only the socialist and labor parties of England, Switzerland, and the

Scandinavian countries survived. As a result no congresses were held after 1931. Exiled socialists from the Continent living in London during World War II continued to meet, and in this fashion a semblance of international unity among socialists was retained.

The first steps toward reestablishing socialist unity were taken in a conference held in May 1946, at Clacton, England. A Socialist Information and Liaison Office (SILO) was set up with an office in Transport House, London. Subsequently a Consultative Committee was organized for an exchange of information, and by the end of 1946 the International Socialist Conference had become a unit within the SILO. A break with the Socialist parties of eastern Europe took place over the endorsement of the Marshall Plan and the cold war. In the meantime, the Consultative Committee had been replaced by the Committee of the International Socialist Conference (COMISCO). The break over cooperation with the Communists and the support of democracy and freedom against the totalitarian powers in the cold war led in 1951 to the transformation of the International Socialist Conference into the Socialist International. The change took place at a meeting in Frankfurt am Main. All parties believing in democratic socialism are eligible to membership. The Socialist International aims to place the means of production in the hands of the people, and it opposes totalitarian communism as a distortion of the Socialist ideal. See also SOCIALISM.

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INTERNATIONAL AFFAIRS. See INTERNATIONAL RELATIONS.

INTERNATIONAL ARBITRATION. See ARBITRATION, INTERNATIONAL.

INTERNATIONAL ASSOCIATION OF WORKINGMEN. See INTERNATIONAL.

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT. See BANKS AND FINANCE—18. *International Bank for Reconstruction and Development.*

INTERNATIONAL CODE. See CODE, INTERNATIONAL.

INTERNATIONAL COMMISSIONS. See COMMISSION.

INTERNATIONAL CONFERENCES. Probably as early as 5,000 B.C. conferences were held by the first known city-states in the Tigris-Euphrates cradle of civilization. But international conferences in the sense of meetings of the representatives of nation-states are no older than the state system itself, that is to say a little more than 300 years, calculated from the Peace of Westphalia in 1648.

WESTPHALIA (1648) TO VIENNA (1815)

In marking the end of the Thirty Years' War, the Peace of Westphalia gave a mortal blow to the myth of one universal state, embodied in the Holy Roman Empire, and acknowledged the independence of Switzerland and the Netherlands and the existence of new, independent states in Germany. The conference, which took eight years

to draft the treaty, established the right of states to exist separately and independently. European states were to find it one thing, however, to assert their independence and quite another to maintain it in the face of challenges from successive aspirants to mastery of the Continent: Louis XIV of France (r. 1643-1715), Frederick the Great of Prussia (r. 1740-1786), and Napoleon, emperor of the French (r. 1804-1814). See also WESTPHALIA, PEACE OF.

International conferences marked the end of each of these attempts at European dominance, and they denote successive systems of organizing international life. The next settlements ranking with Westphalia were embodied in a group of separate treaties known collectively as the Peace of Utrecht (1713), which brought the War of the Spanish Succession (1701-1714) virtually to a close. The Conference at Utrecht, which began in 1712, recognized Philip of Bourbon, grandson of Louis XIV, as the Spanish king, but confirmed the permanent separation of the French and Spanish crowns. The ramifications of the settlement affected all of Europe.

Just about a generation later, the status quo was challenged by Frederick the Great of Prussia, who was eager to assert his hegemony over Austria. The War of the Austrian Succession (1740-1748) found France, Bavaria, Saxony, and Spain joining Prussia to attack the realm of Maria Theresa, while England and the Netherlands joined the young queen in an attempt to preserve her throne and the balance of power. This war was not merely a European conflict—it spread to India and to the New World—but despite its global nature, it was indecisive. By the Peace of Aix-la-Chapelle (1748), Frederick did retain Silesia, but Austria was not partitioned, as Frederick had hoped it would be. Nor was the peace enduring, for in 1756, after a major diplomatic revolution, England joined Prussia to combat Austria, France, Russia, and Sweden, in a struggle to determine whether Austria or Prussia would dominate north Germany and whether Britain or France would govern North America and India. The Treaty of Hubertusburg (1763), which concluded the Seven Years' War, gave the laurels to Prussia, and the Treaty of Paris in the same year found Louis XV surrendering to Britain nearly all the French holdings in America.

Napoleon was next to overthrow the existing order, but the Continental state system emerged supreme at the Congress of Vienna (September 1814 to July 1815), which assembled to remake Europe after Napoleon's abdication. The negotiators adopted the principle of legitimacy as their guideline in their attempt to restore the territorial and dynastic arrangements that prevailed before the French Revolution. At the congress, Austria, Britain, Prussia, and Russia decided the major questions, while the other members of the Grand Alliance (Portugal, Spain, and Sweden) played only peripheral roles. The full congress never met officially, most of the work being done in committees.

The congress made extensive territorial settlements in favor of the restored Austrian and Prussian monarchies, formed the Kingdom of the Netherlands, created the Germanic Confederation, divided Poland, assured England of certain colonial possessions, allowed Sweden to keep Norway, reestablished Switzerland as an independent confederation, and restored legitimate dynasties throughout Europe. The congress also laid down

the seven basic rules for classifying diplomatic representatives (protocol of the session of March 9, 1815), which, together with the supplementary (or eighth) rule of the Congress of Aix-la-Chapelle (Nov. 21, 1818), continue with slight changes to be the basic guidelines for international diplomacy.

One decision of the congress that had far-reaching consequences was that riparian states would administer rivers crossing or forming the boundary of more than one of their number, and would regulate river traffic for the benefit of world commerce. The Treaty of Vienna (June 9, 1815) authorized the riparian states along the Rhine to name commissioners to supervise navigation on the river. They were to meet each year to "establish a perfect control" over navigation on the Rhine. The system of creating international organizations to consider problems of common concern was clearly adumbrated at the Vienna meetings. See also VIENNA, CONGRESS OF.

VIENNA (1815) TO VERSAILLES (1919)

The haphazard alignments of the balance of power had since 1648 maintained the community of nations against those with ambitions to dominate all of Europe; but the desire for a more secure arrangement after 1815 led the European powers to fashion the Holy Alliance and the Quadruple Alliance. Both were designed to carry out decisions made at Vienna and to replace war with the conference method as a means of settling future disputes.

The Holy Alliance (q.v.) was the idea of Czar Alexander I of Russia. It bound the signatories who ultimately included all the sovereigns of Europe except the king of England and the pope) "on all occasions and in all places, [to] lend each other aid and assistance; and regarding themselves towards their subjects and armies as fathers of families, . . . [to] lead them, in the same spirit of fraternity with which they are animated, to protect Religion, Peace and Justice." The czar may have hoped that the alliance would presage some form of international security organization. But the only substance this fraternal spirit among Europe's sovereigns acquired came through the Quadruple Alliance (Great Britain, Austria, Prussia, and Russia). The contracting powers stated in the preamble to this treaty of 1815 that they intended "to fix in advance . . . the line of conduct which they propose to follow in order to guarantee Europe against the dangers that might yet threaten her." Each signatory promised to supply 60,000 men should France violate the Treaty of Paris (imposed on her in 1815 after Napoleon's second abdication). The members of the alliance also agreed to "renew at fixed intervals" their previous conferences—"meetings consecrated to great common objects and the examinations of such measures as at each one of these epochs shall be judged most salutary for the peace and prosperity of nations and for the maintenance of the peace of Europe." The four powers planned specifically to meet from time to time to help carry out the terms of the treaties (which involved maintaining garrisons in 17 fortresses on the northern and eastern frontiers of France). These provisions for later meetings were the basis for successive international congresses, a system of international "government by conference" known as the Concert of Europe (q.v.).

The Congress System clearly assumed that the

great powers were the prime movers of world affairs, and that because they alone were strong enough to keep order, they should take the initiative in prescribing the order they proposed to maintain. Resting solidly on the principle that it was desirable to preserve the balance of power and the status quo, the concert promoted the idea of legitimacy (meaning now the right of the dynasties in power to continue to rule rather than give way to revolutionary and subversive ideas about the sovereignty of peoples). The congresses met every few years between 1815 and 1822. At Aix-la-Chapelle (September 1818), the powers disposed of the question of French indemnities and arranged for the allied troops to withdraw from France. They also admitted France to a new Quintuple Alliance and discussed economic and social issues like the slave trade and the status of Jews. In 1820 and 1821, the congresses of Troppau and Laibach considered the revolutions in Spain and Italy. The Austrian diplomat Prince Klemens von Metternich was eager to use force to crush revolutions that threatened to disturb the peace, but his reactionary ideas offended many liberals in Britain and opened up the first major breach in the Congress System. The final break came at the Congress of Verona (October 1822), which considered the situations in Spain and Greece. Britain's refusal to endorse intervention in Spain lest the conflict spread to the Spanish colonies in the new world did not prevent the intervention, but it did bring the Congress System to an end.

The spirit of the Concert of Europe lingered on in the 19th century, however, even after the concert itself had formally ended. Conferences met as crises arose, usually called by the most interested state. The major powers thus found it necessary to consult together about the Eastern Question (q.v.), and they guaranteed the independence of Greece in the London Protocols of 1829 and 1830. They also provided for the neutrality of Belgium (1839) and Luxembourg (1867); they admitted Turkey "to participate in the public law and concert of Europe" at the Congress of Paris (1856); and at the Congress of Berlin (1878) they compelled Turkey and Russia to accept the revision of the Treaty of San Stefano. At the Berlin Conference on African Affairs (Nov. 15, 1884 to Feb. 26, 1885), 14 nations, including the United States, agreed to suppress slavery and the slave trade, declared that the Congo Basin was a neutral area completely open to commerce and that states were free to navigate on the Congo and Niger rivers. The enlarged group of powers also recognized the Congo Free State, with Belgian King Leopold II as its sovereign. No permanent organs emerged from any of these meetings, and every state remained free to decide in each situation whether it would cooperate or not.

The 19th century also saw a growing number of meetings on economic and social questions. Paris was the center of much of this activity. In 1851, 12 powers attended the first International Health Conference there; Paris was also the site of an international conference of 20 states, which in 1856 established the International Telegraphic Union; and in 1863, several states met to discuss international postal problems. Postal matters were also on the agenda of the Congress of Bern in 1874, where representatives of 22 states met to form the General (later "Universal") Postal Union. Similar unions, each of them founded by

a conference, came into being in the fields of health, sanitation, commerce, finance, and humanitarian reform. As of 1911, 45 such organizations existed, all of them created after 1850. Traditional methods of bilateral negotiations and periodic conferences were giving way to more permanent arrangements—to continuing conferences, in effect, in the form of international organizations.

This evidence of increasing international activity gave rise to the hope that states might at last achieve perpetual peace by adopting a "functional approach," that is to say, by developing the widest possible network of nonpolitical ties among themselves and their nationals. These high hopes were to prove illusory, but no more so than the search for world peace through more direct attempts to improve procedures for settling international political differences and stopping the arms race.

The most noteworthy conferences of the latter type were the two Hague peace conferences. (See *HAGUE COURT—Hague Conferences*.) The first (May 18–July 29, 1899) met at the invitation of the Russian czar, who was finding himself hard pressed to keep up with the arms race. At this conference, 26 states agreed to settle international disputes peacefully, but they also took the occasion to define the laws of war. Specifically, they agreed for the succeeding five years not to use projectiles thrown from balloons and not to engage in gas warfare or to employ dum-dum bullets. They also consented to treat their war prisoners and wounded better than they had in the past. They did not, however, actually arrange to disarm or to limit armaments, and though they rejected the idea of compulsory arbitration, they did establish the Permanent Court of Arbitration (popularly known as the Hague Court), which is in effect a congeries of panels of distinguished citizens upon whom states may call as arbitrators.

The Second Hague Peace Conference (June 15–Oct. 18, 1907) was originally to meet in 1904, but ironically it was delayed because of the Russo-Japanese War. When it did meet, it was as unsuccessful as its predecessor in limiting armaments. The British took the lead in proposing disarmament, but the Germans, who did not wish to limit their growing fleet, were the spokesmen for those states who preferred no limits at all. Again the idea of compulsory arbitration was mooted and abandoned, although the conferees did enlarge the machinery for voluntary arbitration, and concluded other conventions on war, neutrality, and the use of force among states to collect debts. The London Naval Conference (December 1907) was the next attempt at limiting war. There 10 naval powers agreed on rules to regulate naval warfare (blockade, contraband, prizes, convoys), but the pact was never ratified.

BETWEEN TWO WORLD WARS

The war that so many had feared while the nations were meeting in vain efforts to save the peace came in 1914. When it was over, the peace conference, held at Paris in the winter of 1919, addressed itself to the task of remaking Europe. The 27 victorious powers designed the peace to be imposed on Germany, but the decisions rested primarily with the Supreme Council (Council of Ten), consisting of President Woodrow Wilson, Secretary of State Robert Lansing, and the prime ministers and foreign ministers of Britain,

France, Italy, and Japan. See also *WORLD WAR I—15. Diplomatic History of the War: The Peace Conferences and Peace Treaties*.

One outcome of the peace conferences was the formation of the League of Nations. It in effect established a continuing diplomatic conference of states committed to protect one another against aggression, to submit disputes to arbitration or inquiry, and to abstain from war until three months after an arbitral award. The League was distinguished from 19th century conferences in having a permanent secretariat and other permanent organs charged with supervising and adjusting the peace.

The League's activities did not obviate the need for other international conferences. For example, the Washington Conference (Nov. 12, 1921–Feb. 6, 1922) met to consider naval armaments and Far Eastern questions. Nine states (Britain, France, Italy, Belgium, Netherlands, China, Japan, Portugal, and the United States) participated and prepared five treaties: the Four-Power (France, Japan, the United Kingdom, the United States) Pacific Treaty, guaranteeing one another's rights in insular possessions in the Pacific and promising to consult if others should threaten these rights; the Shantung Treaty, by which Japan returned Kiaochow to China; two nine-power treaties, guaranteeing the territorial integrity and administrative independence of China and reiterating the principle of the Open Door; and a Naval Armaments Treaty, providing for a 10-year naval holiday limiting the size and number of ships to be built by the United States, United Kingdom, Japan, France, and Italy. In 1930, the London Naval Conference continued international work along these lines, in a document signed by the same five powers, in which they agreed to regulate submarine warfare and to limit the gun caliber of submarines. Limits imposed on building aircraft carriers, provided for in the Treaty of Washington, were extended, and Japan, the United Kingdom, and the United States also agreed to scrap certain warships and to allocate tonnage in other categories. See also *NAVAL CONFERENCES*.

Postwar economic problems also commanded the international stage. Chief among these were the Conference at Genoa (April 10–May 19, 1922) to consider the Russian problem and general world economic questions; two conferences in London (Aug. 7–14, 1922, and Dec. 9–11, 1922) and one in Paris (Jan. 2–4, 1923) to deal with German reparations payments and allied war debts; and still another meeting in London (July 16–Aug. 16, 1924), which adopted the Dawes Plan for reorganizing the German *Reichsbank* under Allied supervision, adjusted reparation payments, and lent 800 million gold marks to Germany. Reparations and debt problems were also the subject of the Lausanne Conference (June 16–July 9, 1932). The principal effort to cope with the world's economic problems was made at a London International Economic Conference (June 12–July 27, 1933), which disregarded war debts and reparations and tried instead to stabilize currencies. That assembly failed, however, largely because President Franklin D. Roosevelt repudiated its efforts in a message to the conference on July 3. See also *REPARATIONS*.

Earlier manifestations of United States isolation, particularly the country's failure to join the League of Nations, had seriously jeopardized the theory and practice of collective security and

led the European powers to make additional attempts to achieve international peace. One of the most important was the Locarno Conference (Oct. 5-16, 1925) where Germany, France, and Belgium signed a treaty endorsing and protecting the Franco-German and Belgo-German frontiers (with Great Britain and Italy acting as guarantors of the pact); the conference also adopted four arbitration treaties between Germany, on the one hand, and Poland, Czechoslovakia, Belgium, and France on the other. In addition, France agreed to assist both Poland and Czechoslovakia in case Germany attacked them. See also LOCARNO, PACT OF.

At a later conference in Paris (August 1928), the Kellogg-Briand Pact (Pact of Paris) was signed, by which the signatories agreed to renounce war as an instrument of national policy. Ultimately over 60 states subscribed, perhaps because the pact involved no sanctions; at least it proved useless in the face of aggression by Japan in China (1931), Italy in Ethiopia (1935), and Germany in Austria and Czechoslovakia (1938) and Poland (1939).

Despite the outbreak of war in the Far East in 1931, efforts at limiting armaments continued at a disarmament conference of 60 nations in Geneva (February-July 1932). France at this time insisted that states create an international police force, but few others were ready to accept so radical an idea. The Disarmament Conference met again in 1933 (Feb. 2-Oct. 14) and discussed some new versions of the old ideas. By this time, however, Adolf Hitler had come to power in Germany (Jan. 30, 1933) and was in no mood to agree to anything short of German equality with the other powers of Europe. Germany withdrew from the Disarmament Conference on October 14 and from the League on October 23; all pre-World War II efforts at disarming came to an end when the conference disbanded on June 11, 1934.

The initiative in international diplomacy now passed to the fascist powers, who proved themselves masters at staging international conferences in ways that guaranteed to them the maximum diplomatic effect. The most notorious of these conferences—and one which for years to come gave a bad name to conferences in general—was the Munich Conference (q.v.) of Sept. 29, 1938, which followed a Nazi campaign of terror and threats. British Prime Minister Neville Chamberlain and French Premier Édouard Daladier met with the German and Italian leaders and agreed that Hitler should take 10,000 square miles of Czechoslovakian territory, with about 3,500,000 inhabitants. This sacrifice, widely hailed as the price of peace, ultimately proved to be an act of appeasement that enlarged Hitler's appetite and led him less than a year later to attack Poland and thus to open the second world war.

ORGANIZING THE UNITED NATIONS SYSTEM

Even while World War II was in progress, international meetings were being held to organize the peace. An Inter-Allied Declaration, signed June 12, 1941, at St. James's Palace, London, by representatives of five states (Great Britain, Canada, Australia, New Zealand, and the Union of South Africa) and nine governments in exile (Belgium, Czechoslovakia, Greece, Luxembourg, the Netherlands, Norway, Poland, Yugoslavia; and Gen. Charles de Gaulle of France), declared that "the only true basis of enduring peace

is the willing cooperation of free peoples in a world in which, relieved of the menace of aggression, all may enjoy economic and social security." The statesmen pledged that they would "work together, and with other free peoples, both in war and peace, to this end." On Aug. 14, 1941, President Roosevelt and Prime Minister Winston Churchill signed the Atlantic Charter "somewhere in the Atlantic" (actually Placentia Bay, Newfoundland), and expressed their hopes for a world free from fear and want. They endorsed disarmament and the fullest collaboration among states to improve labor standards and to help the world advance in economic and social matters. These objectives were endorsed by the representatives of 26 nations on Jan. 1, 1942, at Washington, D.C., in the so-called "Declaration by United Nations."

More details about the shape of the postwar world emerged as the war progressed. At Moscow, on Oct. 30, 1943, representatives of China, the USSR, the United Kingdom, and the United States declared that the four governments "recognized the necessity of establishing at the earliest practicable date a general international organization, based on the principle of the sovereign equality of all peace-loving states, and open to membership by all such states, large and small, for the maintenance of international peace and security." And on December 1 of that year, President Roosevelt, Premier Joseph Stalin, and Prime Minister Churchill acknowledged at their meeting at Teheran, Iran, that they had the "supreme responsibility . . . to make a peace which will command the goodwill of the overwhelming masses of the peoples of the world and which would banish the scourge and terror of war for many generations." See also WORLD WAR II—14, *Diplomatic History*.

These generalizations found their way into more specific proposals for a postwar United Nations organization at a conference at Dumbarton Oaks in Washington, D.C. The meetings were held in two parts (Aug. 21-Sept. 28, 1944, for representatives of the USSR, the United Kingdom, and the United States; and Sept. 29-Oct. 7, 1944, for representatives of China, the United Kingdom, and the United States). Afterward, the powers made public the design of a world organization with a Security Council on which the Big Five (China, France, the USSR, the United Kingdom, and the United States) would be permanently represented. At Yalta, USSR, at a meeting of the United States, British, and Soviet leaders, on Feb. 11, 1945, the Big Three agreed that "a conference of United Nations" should be called to meet at San Francisco on April 25, 1945, to prepare the charter of an organization, along the lines proposed in the informal conversations of Dumbarton Oaks.

Despite Roosevelt's death on April 12, the San Francisco Conference, with 50 nations present, met as scheduled between April 25 and June 26, 1945, where the plans laid at Dumbarton Oaks and Yalta were modified by the conference itself and resulted in the Charter of the United Nations and the Statute of the International Court of Justice. See also UNITED NATIONS.

Other international conferences marked the origins of many new intergovernmental organizations associated with the United Nations: Food and Agriculture Organization (FAO)—Hot Springs, Va., May 1943; International Bank for Reconstruction and Development and Interna-

tional Monetary Fund—Bretton Woods, N.H., July 1–22, 1944; International Civil Aviation Organization—Chicago, Ill., Nov. 1–Dec. 7, 1944; International Atomic Energy Agency—United Nations, New York, Sept. 20–Oct. 26, 1956; Intergovernmental Maritime Consultative Organization—Geneva, March 6, 1958; United Nations Education, Scientific and Cultural Organization (UNESCO)—London, Nov. 1–16, 1945; World Health Organization (WHO)—New York, July 1946.

Aside from being a continuing conference itself, the United Nations has called special conferences on many important topics. Among them have been:

(1) Conference on Freedom of Information (1948), in Geneva, which prepared three draft conventions on gathering and transmitting news, on freedom of information, and on the right of correcting inaccurate reports.

(2) Scientific Conference on the Conservation and Utilization of Resources, attended by experts from over 50 countries, held at Lake Success, New York, Aug. 17–Sept. 6, 1949.

(3) Two United Nations international conferences on the Peaceful Uses of Atomic Energy (Aug. 8–20, 1955 and Sept. 1–13, 1958), which studied the development of atomic power and other activities suitable for effective international cooperation, such as biology, medicine, and radiation protection; both conferences met in Geneva and were attended by scientists from about 70 states each time.

(4) A two-week World Food Congress (June 1963), in Washington, which took up the challenge of eliminating hunger and malnutrition in the world.

(5) Commodity conferences every few years to regulate (or discuss the possibility of regulating) the markets in tin, coffee, sugar, wheat, olive oil, cocoa, copper, lead, and zinc.

PEACEMAKING AFTER WORLD WAR II

When the second world war ended, the great powers attempted to settle the peace in a series of international conferences. Peacemaking in the postwar world was to be no easy task, however, and the process of liquidating the issues raised by World War II was still going on nearly two decades after hostilities ceased.

Procedure.—The Council of Foreign Ministers was the principal group concerned with postwar problems. Established at the Potsdam Conference (July 17–Aug. 2, 1945), the Council comprised the representatives of the five victorious great powers who were also the permanent members of the U.N. Security Council. They were ultimately to meet eight times between 1945 and 1954 in efforts to agree among themselves on the shape of the postwar world. The Paris Peace Conference itself was held from July 29 to Oct. 15, 1946.

MEETINGS OF THE COUNCIL OF FOREIGN MINISTERS

Dates	Place
Sept. 11–Oct. 2, 1945	London
Dec. 16–26, 1945 (interim meeting)	Moscow
April 25–May 16, and June 15–July 12, 1946	Paris
Nov. 4–Dec. 12, 1946	New York
March 10–April 24, 1947	Moscow
Nov. 25–Dec. 16, 1947	London
May 25–June 21, 1949	Paris
Jan. 25–Feb. 18, 1954	Berlin

The council was to prepare the proposals for the final peace settlements with Italy, Rumania, Bulgaria, Hungary, Finland, Austria, and Germany. Early in the council meetings, a procedural problem arose that delayed matters considerably and fundamentally affected the council's work. The Potsdam protocol provided that only the signatories of the surrender terms could "discharge . . . these tasks" of making the treaties. Neither France nor China had been signatories, although the Potsdam agreement specifically stated that France might be a party to the discussions in the case of the Italian treaty. Nonetheless, on Sept. 22, 1945, the USSR objected that the council's original decision of September 11 to allow China and France to discuss all the treaties was illegal.

The United States maintained that everyone had understood at Potsdam that even the non-signatories might discuss the treaties, although only the signatories could vote. United States Secretary of State James Byrnes then tried to compromise with the Soviet Union by agreeing that France and China would not continue discussing the treaty principles if in turn the USSR would allow the final peace treaties with the five countries to go before a peace conference of all European members of the U.N. and all non-European states that had supplied substantial military contingents in the war against the European members of the Axis.

At the interim meeting of the council in Moscow, later in 1945, the ministers in effect adopted the Byrnes compromise. They agreed with the USSR to abide by the letter of the Potsdam Agreement and to allow only those states that signed the armistices to draw up the original drafts. But they also endorsed the American plan to permit the drafts to go before a general peace conference. The conference would then consider the drafts and prepare its own recommendations. The Big Three (or Four, in the case of the Italian treaty) would next consider the conference's recommendations and prepare the final texts, which all states would sign. This plan did not give all the belligerents as much of a hand in making the peace treaties as they might desire, but it did allow them all to criticize the proposals of the larger powers.

Thus it was that at the second part of their first meeting in Paris the ministers agreed to call a peace conference, to open in Paris on July 29, 1946. At that time 21 nations met in Paris to put their seal on the work of the Big Four. With the conference's recommendations in hand, the council then met in New York to complete the texts of the peace treaties with the five states.

The Italian Treaty.—The Italian treaty was on the foreign ministers' agenda in 1945 and 1946. The principal questions on which the USSR and the Western powers differed related to reparations, the former Italian colonies, and the Italian-Yugoslav boundary, particularly as it concerned the city of Trieste. A compromise was reached on the reparations problem. The council never was able to agree about the colonies, and they ultimately allowed the U.N. General Assembly to dispose of them in 1949. The Trieste question lingered on until October 1954, when Italy, the United Kingdom, the United States, and Yugoslavia signed the London Memorandum of Understanding, defining the jurisdiction of both Italy and Yugoslavia in the area.

The Finnish and Balkan Treaties.—The United States maintained that the Bulgarian and

Rumanian governments did not represent their people and did not allow all of them to enjoy basic human rights. The ministers then agreed on certain steps to broaden the base of the two Balkan governments. The Soviet Union argued against including in the treaties any terms that would promise freedom of commerce on the Danube; and the USSR also insisted on limiting the economic contacts between the Central European states and the rest of the world. By the terms of the Belgrade Convention of Aug. 18, 1948, a treaty signed by the USSR and her Balkan satellites, an end was put to the nearly 100-year old internationalized regime on the Danube. The treaties included provisions calling for reparations for the USSR of \$300 million (in 1938 prices) in commodities from Rumania, Hungary, and Finland, and \$70 million from Bulgaria.

German and Austrian Treaties.—By agreement at New York, the German and Austrian questions came before the foreign ministers at their 1947 meeting in Moscow. In these negotiations, all the disagreements so evident during the conferences on the Italian and Balkan treaties came into sharp focus and remained in effect unsolved. The foreign ministers agreed that they should lay the foundations for a central government for Germany; bring about the economic unity of Germany; establish workable boundaries; and set up a guaranteed control through a four-power treaty. Austria was to be promptly relieved of occupation burdens and treated as a liberated and independent country.

When it came to translating these general principles into specific treaties, however, the foreign ministers were far apart. Generalissimo Stalin told United States Secretary of State George C. Marshall that the Moscow meetings were really just the first skirmishes and brushes of reconnaissance forces on the German question, and that compromise would come, but only after people had exhausted themselves in dispute. And by and large, the London meetings, held later in the year, were but a dreary repetition of what had been said and resaid in Moscow. The central question was whether Germany was to continue divided or whether the Allies could agree on how to unify their former enemy. The United States wanted the Soviet Union to eliminate the artificial zonal barriers and permit persons, ideas, and goods to move freely through all of Germany. With certain basic problems solved, the West believed that they could establish a provisional government for Germany. The USSR, however, refused to supply information either about reparations it had already taken out of east Germany or about economic conditions there, and thus made it impossible even to consider the German question in a preliminary way. The USSR refused to consider the boundary question and called instead for the powers to establish a central German government immediately. To the West, Russia's refusal to proceed in a logical order indicated that the Soviet Union was using the meeting as an opportunity to make propaganda declarations that sounded pleasant to German ears. Although a peace treaty with Austria was finally signed in 1955, no peace treaty had been signed with Germany as late as 1963.

Japan.—In 1947 the United States proposed a preliminary conference of the Big Five, Australia, Canada, India, the Netherlands, New Zealand, and the Philippines to consider plans for a Japanese peace treaty. The USSR insisted, how-

ever, that only the Council of Foreign Ministers (where they had a veto) could consider the treaty. The United States therefore decided to abandon the conference method, which afforded so many possibilities for the USSR to obstruct proceedings, in favor of negotiation through successive bilateral discussions that no single nation could thwart.

In June 1951, after having consulted with the states concerned, the British and Americans prepared a joint draft agreement. The Soviet Union took an active but reluctant part in the proceedings. From September 4 to September 8 the nations gathered in San Francisco to sign the treaty, which restored sovereignty to Japan and was, in general, not vindictive. Peace between Japan and China and the disposition of certain territories were left to the future. And since the USSR refused to sign the treaty, the problem of peace between Japan and the USSR also remained unsettled until they signed separate agreements in the fall of 1956.

For a further discussion of the World War II peace treaties, see *WORLD WAR II—15. Postwar World*.

SECURITY TREATIES

Increasing Soviet hostility in diplomacy, her assistance to the forces of international communism, the coup in Czechoslovakia and the Berlin Blockade in 1948, and the outbreak of hostilities in Korea in 1950—all these developments forced the West to look to its defenses in the postwar period.

One of the most important meetings for the security of the Western Hemisphere took place at Rio de Janeiro, Brazil; the Conference for the Maintenance of Continental Peace and Security (Aug. 15–Sept. 2, 1947), which 21 American states attended, produced the Inter-American Treaty of Reciprocal Assistance (ratified by the United States on Dec. 19, 1947). The treaty stated (Article 3) that “an armed attack by any State against an American State shall be considered as an attack against all the American States and, consequently, each one of the . . . Contracting Parties undertakes to assist in meeting the attack in the exercise of the inherent right of individual or collective self-defense recognized by Article 51 of the Charter of the United Nations.” And at their Ninth International Conference, in Bogotá, Colombia (March 30–May 2, 1948), the American states adopted the Charter of the Organization of American States (OAS), a revised and strengthened regional organization with responsibilities for defense, and economic and social development.

That same year five European nations (Britain, France, Belgium, the Netherlands, and Luxembourg) met at Brussels (March 17, 1948) to sign a 50-year defense pact, by which they agreed to aid one another should an aggressor (they had Germany in mind) attack. And on April 4, 1949, the representatives of 12 Western nations (Belgium, Canada, Denmark, France, Iceland, Italy, Luxembourg, the Netherlands, Norway, Portugal, the United Kingdom, and the United States) met in Washington to sign the North Atlantic Treaty. Building on the formula of the Rio Pact and the example of the Brussels organization, the North Atlantic Treaty Organization (NATO) powers agreed that “an armed attack against one or more of them in Europe or North America shall be considered an attack against them all,” and

pledged themselves to take such action as each deemed necessary, "including the use of armed force," in case of attack.

So that Germany might be included in the defense of the West, the British arranged, through a series of conferences in London and Paris in September and October 1954, to have the five Brussels Pact powers invite Italy and the Federal Republic of Germany to join them in a new defense arrangement known as the Western European Union (WEU). Through WEU they established certain controls over Germany's armed forces and armaments (such as denying Germany access to atomic, bacteriological, and chemical weapons), and thus created an organization that permitted Germany to have her independence and to join NATO. See also NORTH ATLANTIC TREATY and WESTERN EUROPEAN UNION.

In the Pacific area, several interrelated pacts entered into force on April 15, 1952, at the same time as the Japanese Peace Treaty. Each of these was arranged in separate conferences with the parties concerned. One was a security treaty between the United States and Japan (signed Sept. 8, 1951 and revised in 1960); another was a treaty between Australia, New Zealand, and the United States (the ANZUS Pact, signed Sept. 1, 1951). The United States signed two other bilateral security treaties, one with the Republic of Korea (Oct. 1, 1953) and another with the Republic of China (Formosa) on Dec. 2, 1954. Capstone of the Pacific defense arrangements was the Southeast Asia Treaty Organization (SEATO, q.v.) to Cambodia, Laos, and North Vietnam. The multitude of Pacific treaties contrasts sharply with the more unified European security design. The more complex pattern was essential, however, because the three countries that had been victims of Japanese aggression were reluctant to join in a mutual security pact with Japan. Moreover the Pacific powers could not agree on the areas they were all prepared to defend.

The final link in the United States-designed network of security treaties came in 1955 with the development of the defensive alliance system known as the Baghdad Pact. Iran, Iraq, Turkey, Pakistan, and the United Kingdom were the signatories. When Iraq defected after a revolution in July 1958, it was renamed the Central Treaty Organization (CENTO, q.v.), with new headquarters in Ankara, Turkey.

On the Communist side, there was no comparable international complex of security treaties, but the Communist powers held several important conferences. Pursuing its vigorous anti-Western line, the USSR took the lead in September 1947 in Warsaw in establishing a new international Communist center, the Communist Information Bureau (Cominform) to link the Communist parties of the Soviet Union and the East European states together with the important western Communist parties in France and Italy. The Cominform was dissolved, however, on April 17, 1956, as a conciliatory gesture toward Yugoslavia. On Feb. 14, 1950, at a meeting in Moscow, the Chinese and Soviet leaders signed a mutual defense treaty. In May 1955, Albania, Bulgaria, Czechoslovakia, Hungary, East Germany, Poland, Rumania, and the USSR signed a 20-year

treaty of friendship, cooperation, and mutual assistance at Warsaw. The Warsaw Pact signatories argued that the treaty was necessary because "of a new military alignment in the shape of 'Western European Union,' with the participation of a remilitarized Western Germany and the integration of the latter in the North Atlantic bloc."

ARMISTICE AGREEMENTS

Security treaties notwithstanding, hostilities broke out to plague the postwar world and international conferences were essential to establish armistices in all these areas.

Arranging an armistice in Korea after hostilities broke out there on June 25, 1950, proved a prolonged matter. Negotiations began between opposing military commanders on June 10, 1951, at Kaesong in Korea. On October 25 they were reopened in the Korean town of Panmunjom. They continued until Oct. 8, 1952, when they were recessed indefinitely because of disagreement about the repatriation of the prisoners of war. The two sides did agree to exchange sick and wounded prisoners in April 1953; negotiations reopened and an armistice agreement was signed on July 27, 1953.

The problems of Korea and Indochina were the subjects of a conference at Geneva (April 26–July 21, 1954), agreed upon by the Conference of Foreign Ministers the February before. The 16 countries that had taken part in the Korean hostilities on the U.N. side (Australia, Belgium, Canada, Colombia, Ethiopia, France, Greece, Luxembourg, the Netherlands, New Zealand, Philippines, Republic of Korea, Thailand, Turkey, the United Kingdom, and the United States), as well as North Korea, the People's Republic of (Communist) China, and the USSR, participated in the Korean phase of the conference. But the attempt to carry out the U.N. resolutions calling for a unified, independent, and free Korea foundered, according to a declaration issued June 15, 1954, by the members of the U.N. command, because the Communist delegations refused to recognize the authority of the U.N. and would not accept impartial and effective supervision of elections in the country.

Representatives of eight governments—Cambodia, the Democratic Republic of (North) Vietnam, France, Laos, the People's Republic of (Communist) China, the State of (South) Vietnam, the USSR, and the United Kingdom—and the United States took part in the Indochinese phase of the conference. The eight issued a Final Declaration on July 21, 1954, taking note of agreements ending hostilities in Cambodia, Laos, and Vietnam and organizing international control and supervision of the armistice arrangements. In a separate statement, the United States associated itself with all but one paragraph of the Final Declaration, paragraph 13, which bound the conferees to meet again to consult one another on any question referred to them by the International Supervisory Commission (Canada, India, and Poland).

Deteriorating conditions in Laos led to another conference in Geneva, this time of 14 nations, which met intermittently from May 16 to Dec. 4, 1961, and which took two steps toward guaranteeing the independence and neutrality of Laos. The conferees approved international investigatory procedures for the Southeast Asian kingdom and charged the United Kingdom and

the USSR with the responsibility of supervising the treaty.

CONTROL OF ARMAMENTS

Since World War II, the major powers, compelled by the awesome nature of atomic weapons, have negotiated intermittently on disarmament and have been under constant pressure from the United Nations to resume talks each time a recess has threatened to go on too long. From 1947 to 1952, the principal forums for the attempts to regulate armaments were the U.N. Atomic Energy Commission and the Commission for Conventional Armaments. After 1952, the work of these two bodies was combined in a single Disarmament Commission, whose members (1952-1958) were the Security Council members and Canada (when Canada was not a member of the Security Council). In addition, from 1954 to 1957 a Subcommittee of Five (Canada, the United Kingdom, the United States, the USSR, and France) was the principal forum for disarmament talks. When this group reached a stalemate in 1957, the United Nations attempted to keep the talks going by enlarging the Disarmament Commission to give it 25 members, but the USSR refused to participate, arguing that the commission was still not representative enough. But when the membership was made identical with that of the United Nations, the commission became too unwieldy for any talks. In fact, 1957 is the last year, and the Subcommittee of Five the last body, in which meaningful disarmament talks actually took place directly within the United Nations.

Thereafter, the U.N. General Assembly continued to urge the powers concerned to carry on their conversations outside the world organization. This they have done in various ways. In 1958 Soviet and American experts conferred in two gatherings on how to avoid surprise attacks (Nov. 10-Dec. 18, 1958) and how to detect violations of a nuclear test ban (July 1-Aug. 21, 1958). On Oct. 31, 1958, the Geneva conference on discontinuing nuclear tests began among the United States, the United Kingdom, and the USSR. A 10-nation committee (5 from the East and 5 from the West) outside the United Nations started work on disarmament on Sept. 7, 1959. In June 1960 the Soviet Union refused to continue negotiating, however, allegedly because the United States U-2 "spy flights" over the USSR had proved to them that the West was not sincere in their efforts to disarm. From 1960 to 1962, therefore, no disarmament talks took place. But in 1962, the 10-nation committee was enlarged to 18, to include 8 neutralist states. (France, though a member, refused to participate.)

On June 21, 1963, the Disarmament Conference in Geneva recessed to allow for a three-power discussion on a nuclear test ban in Moscow. On August 5, a treaty prohibiting nuclear testing in the atmosphere, in space, and under water was signed in Moscow by United States Secretary of State Dean Rusk, Soviet Foreign Minister Andrei A. Gromyko, and the Earl of Home, British foreign minister. A communique issued at the time of the signing stated that the three governments considered this only a first step toward peace; others were invited to join the treaty. Although underground testing was not prohibited, the treaty pledged the three powers to continue negotiations for the discontinuance of all nuclear testing of all kinds.

See also DISARMAMENT.

ECONOMIC CONFERENCES

International conferences on economic problems in the postwar period produced more agreement than the meetings devoted to military matters. In a speech at Harvard University on June 5, 1947, Secretary of State George C. Marshall invited European countries to agree upon a recovery program that the United States could support. Within two days the British foreign minister, Ernest Bevin, was consulting in Paris with Georges Bidault, his French counterpart, about such a plan. They invited Soviet Foreign Minister V. M. Molotov to join them, and the three discussed European recovery in Paris from June 27 to July 3, without coming to any agreement on a common approach. The Soviet position was that each European state should give the United States its individual request for economic assistance; Molotov flatly refused to agree that a plan of intra-European assistance was desirable or possible. The British and French governments then invited all the European states (except Germany, Spain, and the USSR) to meet in Paris on July 12, 1947, to prepare a joint program embodying Europe's needs, resources, and requirements.

The invitation was accepted by 14 states (Austria, Belgium, Denmark, Greece, Ireland, Iceland, Italy, Luxembourg, Norway, the Netherlands, Portugal, Sweden, Switzerland, and Turkey). These established a Committee for European Economic Cooperation, comprising a representative of each state, and an Executive Committee of five states. The representatives prepared a comprehensive program covering four years, 1948 to 1951, which the conference adopted on Sept. 22, 1947, and forwarded to Washington. Later negotiations conducted by Britain and France led to a second meeting of the committee in Paris in March 1948. This conference in turn produced the Convention on European Economic Cooperation, which was signed in Paris on April 16, 1948, and established the Organization for European Economic Cooperation (OEEC). See also ECONOMIC COOPERATION ADMINISTRATION, THE.

The economic and military efforts to unite Europe had counterparts on the political side, although the initiative for a political union lay with private groups rather than with governmental authorities. A "Congress of Europe" met at The Hague from May 8-10, 1948, comprising 713 delegates from 16 countries and observers from 10 others. The congress attempted to demonstrate how wide the support for European unity was. The president of honor was Sir Winston Churchill, and the participants included other former governmental, parliamentary, and civic leaders. They adopted resolutions calling for an economic and political union in Europe, and in September 1948, the Belgian and French governments submitted these proposals to the Permanent Council of the Brussels Treaty powers. After referring the matter to a five-power "Committee for the Study of European Unity," the Brussels powers agreed in January 1949 to set up a Council of Europe, consisting of a ministerial committee meeting in private, and a parliamentary body meeting in public. The powers also agreed to convene a conference of ambassadors to work out the details and invited five other countries (Ireland, Italy, Denmark, Norway, and Sweden) to join the talks. Negotiations continued in London and resulted in the Statute of the Council of

Europe, signed on May 5, 1949. See also EUROPE, COUNCIL OF.

International conferences have brought into being a variety of European regional arrangements: the European Payments Union (EPU, q.v.) on Sept. 19, 1950; the European Coal and Steel Community (ECSC, q.v.) on April 18, 1951; and the European Community on March 10, 1953. The Statute for the European Community was drafted by a constitutional committee, various subcommittees, and a "working party," formed by the Common Assembly of the ECSC at the invitation of the six ministers for foreign affairs of the ECSC countries. These groups met from Sept. 15, 1952, until Feb. 25, 1953, preparing the draft treaty.

All these preliminary arrangements paved the way for the European Economic Community (EEC, q.v.), known as the Common Market. Plans for this important organization were drafted by the foreign ministers of "Little Europe" (Belgium, France, West Germany, Italy, Luxembourg, and the Netherlands) at Messina, Italy, in June 1955. They then established an Intergovernmental Conference, which met in Brussels through the winter of 1955-1956 with Paul-Henri Spaak, foreign minister of Belgium, in the chair. In April 1956 the conference produced a report suggesting how the "Six" might create a customs union and an agency for exploiting atomic energy. The foreign ministers approved the report in Venice in May 1956 and issued instructions for drafting the treaties, which the Brussels Conference set about doing. Early in 1957 they completed their work, and the treaties establishing the EEC and the European Atomic Energy Community (Euratom, q.v.) were signed in Rome on March 25, 1957. The two communities came into existence on Jan. 1, 1958. Both provided for executive, parliamentary, judicial, and intergovernmental organs, like those of the ECSC, although the powers of the executive bodies were not so great as those of the latter. A European Free Trade Association (EFTA, q.v.) was created by the Treaty of Stockholm and came into being on May 3, 1960, to coordinate trade policies among the "Outer Seven" (Austria, Denmark, Norway, Portugal, Sweden, Switzerland, and the United Kingdom), states not in the Common Market.

A charter for a new Organization for Economic Cooperation and Development (OECD) was drafted in Paris in November 1960, to take effect on Sept. 30, 1961 and to replace the OEEC. The OECD planned to work to speed economic growth, to increase employment, to help its members aid underdeveloped areas, and to expand multilateral, nondiscriminatory world trade. It has 20 members (all of Western Europe plus Canada, Turkey, and the United States).

A series of international conferences have been held under the provisions of the General Agreement on Tariffs and Trade (GATT), drawn up in 1947 at Geneva. In addition to regular sessions to work out detailed procedures, GATT has held several major tariff conferences: in 1949 at Annecy, France; in 1950-1951 at Torquay, England; in 1956, 1960-1961, and 1963 at Geneva. These conferences have helped reduce or stabilize duties on tens of thousands of items in international trade. All countries adhering to GATT have taken part in these tariff negotiations; in fact states adhering to GATT have to undertake to reduce their own tariffs beforehand.

ASIAN AND AFRICAN CONFERENCES

Not all contemporary international conferences have been held by nations traditionally prominent in diplomacy. The first large-scale Afro-Asian conference was held at Bandung, Indonesia, in April 1955. The participants included the "uncommitted" Afro-Asian states, the Asian members of SEATO, and the Communist states of China and North Vietnam. Racist undercurrents were apparent at Bandung, but the conference's principal formal action was to endorse the "five principles of coexistence," the *Panch Chila*, which Prime Minister Jawaharlal Nehru of India and Communist Chinese Foreign Minister Chou En-lai had subscribed to in a Sino-Indian agreement on Tibet on April 29, 1954. These principles were: (1) mutual respect for each other's territorial integrity and sovereignty; (2) mutual nonaggression; (3) mutual noninterference in internal affairs; (4) equality and mutual benefit; and (5) peaceful coexistence. The Bandung Conference symbolized the advent of the Asian-African states on the world stage as a force the rest of the world could no longer ignore.

In the fall of 1961, the Afro-Asian states met in Belgrade on the invitation of Marshal Tito, who had earlier in the year toured Africa extensively. A preparatory conference in Cairo (June 1961) worked out the qualifications for attending the Belgrade Conference; it was decided that states would not be invited just because they were members of a geographical region, but only if they were "noncommitted." As defined in Cairo, the term was applied to states that were independent of the two major power blocs, that displayed "clear tendencies and efforts" to sustain such a policy of independence, that tried to coexist with states of different social systems, or that, even if they were members of military alliances, gave evidence of being free from involvement in conflicts. The Belgrade Conference of the "nonaligned" excluded African states closely associated with France, but invitations went to Austria, Sweden, and Ireland (all of whom declined) and several Latin American states. Of these, Cuba sent a fully accredited delegate, and three (Brazil, Bolivia, and Ecuador) sent observers.

The movement for cooperation among the African states alone gained momentum after Ghana became independent in 1957. The first conference of Independent African States was held in Accra, Ghana, in 1958 with eight states participating (Ethiopia, Ghana, Liberia, Libya, Morocco, Sudan, Tunisia, and the United Arab Republic). Since then, the African states have split into two groups, the so-called Brazzaville Group (named for a meeting in that city in December 1960, attended by 12 states formerly under French rule) and the Casablanca Group (which takes its name from a meeting in that city in January 1961, attended by Ghana, Guinea, Mali, Morocco, the United Arab Republic, Libya, Ceylon, and the Algerian nationalists; the last three were not invited to sign the charter, but they took part in the deliberations). The Brazzaville Group, receiving considerable aid from France, adopted a "moderate" view of the Congo and Algerian questions. The Casablanca Group supported the factions backing Patrice Lumumba in the Congo and generally took a militant anticolonial line. They attacked the Brazzaville states as dupes of the former colonial powers, whom they ac-

cused of attempting to divide and thus control Africa.

A still wider grouping developed in May 1961, when the Brazzaville states met with seven other African countries at Monrovia, Liberia, where Nigeria played a leading role. The Casablanca Group refused to attend both this conference and another held at Lagos, Nigeria, in January, 1962. In meetings held in Addis Ababa, Ethiopia, in May 1963, African states formed the Organization for African Unity, an all-African association with a secretariat, a council of ministers, and a commission to mediate disputes between African states. Kwame Nkrumah, president of Ghana, failed to persuade the conference that Africa unite immediately under a federal government. A more moderate position, which ultimately found expression in the charter adopted by the conference, was espoused by Ethiopia, Nigeria, and Tanganyika. See also AFRICA—12. *Emergence of Modern Africa*.

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INTERNATIONAL COURT OF JUSTICE, judicial organ of the United Nations, frequently referred to as the **WORLD COURT**. This agency for settling international legal disputes and strengthening international law was successor to the Permanent Court of International Justice (q.v.), which had been created by the League of Nations in 1920 but, with the latter, was discontinued after World War II. The statute of the new World Court, which formed part of the Charter of the United Nations adopted in 1945 (see UNITED NATIONS), was almost identical with that of the old court. It was opened automatically only to members of the United Nations, thus excluding some parties to the old court statute not originally admitted to the latter organization. Nonmembers may, however, become parties to the statute of the court on conditions determined by the General Assembly on recommendation by the Security Council. Switzerland, Liechtenstein, and San Marino have taken advantage of this opportunity. Furthermore, the court is open to states not parties to the statute on conditions laid down by the Security Council.

The 15 judges, nominated so as to assure the competence of all in international law and the representation of each of the principal legal systems of the world, are elected by concurrent votes of the United Nations General Assembly and Security Council without great-power veto in the latter body. The earlier court met once a year only for a stipulated term, but the new court is in permanent session.

The United States never became a member of the League of Nations nor a party to the statute of the Permanent Court of International Justice, but it was an original member of the United Nations and, therefore, party to the court statute from the beginning. Furthermore, the United States accepted the compulsory jurisdiction of the court in 1946, but with the Senate's Connally Reservation, giving it discretion to exclude the exercise of that jurisdiction in any case which it regarded as within its domestic jurisdiction.

At the first session of the General Assembly and Security Council in 1946, the judges were elected, 5 for a full nine-year term, and 5 each for six and three years respectively. The American judge elected was Green H. Hack-

worth, former legal adviser to the State Department, succeeded in 1961 by Philip C. Jessup of Columbia University, formerly United States ambassador-at-large. The other 14 judges came from Belgium, Brazil, Canada, Chile, China, Egypt, El Salvador, France, Great Britain, Mexico, Norway, Poland, the Soviet Union, and Yugoslavia. After the election of 1961, judges from Argentina, Australia, Greece, Italy, Japan, Panama, and Peru had replaced those from Brazil, Canada, Yugoslavia, Belgium, Norway, El Salvador, and Chile.

The salaries of the judges were fixed at 44,000 Dutch guilders a year, with a special allowance of 15,000 guilders for the president of the court and a maximum of 10,000 for the vice president. The first meeting of the International Court of Justice was held in April 1946, at The Hague, seat of its predecessor.

The court, like its predecessor, has contributed much to the development of international law, but it has been used less frequently than was the earlier court in spite of a resolution of the General Assembly in 1947 urging more frequent use. A committee of the American Bar Association on World Peace Through Law has urged repeal of the Connally Reservation and American initiative toward greater use of the court.

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INTERNATIONAL DATE LINE, an irregular line roughly coincident with the 180th meridian of longitude on maps of the world, and used to adjust for the necessary difference of one day in time in traveling either eastward or westward around the full circumference of the earth. This adjustment is made necessary by the fact that in proceeding eastward or westward, the time becomes respectively one hour later or earlier for each 15° of longitude covered. If the entire circumference (360°) of the earth is traversed, a full day (24h) is thus gained or lost. The location of the date line in the middle of the Pacific Ocean, exactly opposite (in the antipodes) from the *prime meridian* of Greenwich, provides a convenient location in which to make the change of date without confusion in the affairs of everyday life. Actually, the line deviates around certain small land masses to avoid separating component islands of a group or an archipelago from each other or from the time zone of their protectorate country. In crossing the date line from east to west, the date becomes one day later (for example, the date Monday, March 21 becomes Tuesday, March 22); in crossing the date line eastward, the date becomes a day earlier (thus Thursday, September 21 becomes Wednesday, September 20). Although now generally recognized by all countries, the International Date Line has not been officially adopted as was the prime meridian of Greenwich at the International Meridian Conference held in 1884 in Washington, D.C. See also TIME, INTERNATIONAL ZONES OF.

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INTERNATIONAL EDUCATION. If given its broadest meaning in current usage, the term "international education" denotes all kinds of educational relations among nations. Thus in-

ternational education is concerned with such matters as the exchange of teachers, students, and educational materials, technical assistance to other countries, and educational research and conferences on an international scale. It embraces the subject of "comparative education," which is the comparative study of educational theories and practices in different countries. It has recently acquired also the connotation of broadening the curriculum so as to introduce the student to men of all parts of the world. More narrowly, the term is applied to international educational programs, carried out by governmental and non-governmental agencies, for the purpose of promoting understanding and amity among nations.

Development between 1900 and 1939.—During the 19th century an international perspective in education had developed. The pace quickened between 1900 and 1940 with the establishment of international scholarships, arrangements for the exchange of students and teachers, and the founding of organizations aimed at promoting study abroad. Perhaps the best known of the scholarships was that named after Cecil J. Rhodes (1853–1902), the British financier and administrator in South Africa. He left a major share of his vast fortune for the establishment of perpetual scholarships at Oxford University to be held by students from the larger British colonies and the United States. See also RHODES SCHOLARSHIPS.

A foundation to finance a variety of educational activities in China and the United States was established in 1925, the China Foundation for the Promotion of Education and Culture. The League of Nations entered the field of international education when the Council of the League established a Committee on Intellectual Cooperation, to promote the circulation of intellectual works between nations.

The Institute of International Education, a private nonprofit organization, was founded in 1919 by Stephen Duggan, Elihu Root, and Nicholas Murray Butler. It appealed to colleges and universities in the United States for scholarships to be offered to carefully chosen foreign students. The institute also asked the governments of other countries to offer scholarships to American college graduates for study in their universities, these being government institutions. Some foreign countries gladly matched the scholarships provided by American institutions. By the start of World War II in 1939, the institute had facilitated the exchange of approximately 5,000 students on scholarships between institutions of higher education in the United States and other countries. Following World War II it greatly expanded its activities, working largely under formal agreements with the United States Department of State.

The Bureau International d'Éducation was founded in Geneva in 1925 to aid the cause of international education by conducting research, providing information, and holding international conferences. The Institut Universitaire de Hautes Etudes Internationales was also established in Geneva in 1927 by the Swiss cantons with the assistance of the Laura Spelman Rockefeller Memorial. Affiliated with the University of Geneva, it aims to promote international solidarity, and is a center of study for contemporary international questions of legal, economic, social, and political importance.

In 1934 the government-supported British Council was established to promote greater

knowledge abroad of the United Kingdom and of the English language. It encourages the teaching of English and of British studies in foreign countries, and through books, magazines, lectures, and cultural activities it fosters wider understanding of British life and customs.

The United States government became increasingly involved in international education after the middle of the 19th century. Congress in 1896 assigned the United States Office of Education the statutory responsibility of carrying out and publishing studies of education in other countries. In 1906 the United States became a participant, through membership, in the Pan American Union's educational program. In 1936 it acceded to the Buenos Aires Cultural Convention, with its provisions for the exchange of students and teachers.

The Immediate Postwar Period.—At the close of the war the nations of the West were immediately confronted by two major problems in international education: (1) the reconstruction of the educational systems of the war-devastated countries; and (2) the education of the defeated nations in the ways of democracy.

The Commission for International Educational Reconstruction, established in 1946, grew out of a series of conferences called by the American Council on Education to consider the critical problems of education in the war-devastated countries. The commission endeavored to stimulate and coordinate American voluntary efforts on behalf of education in the war-torn lands. Before the close of World War II, interested agencies of the United States and certain allied countries cooperated in formulating policies for the reeducation of the Axis nations. These policies called for the suppression of highly nationalistic teaching and the furtherance of instruction in democratic ideals.

From 1945 to the Present.—*International Agencies.*—An important step in the development of international education was taken when the United Nations Educational, Scientific, and Cultural Organization (UNESCO, q.v.) came into being in 1946. Its charter provides for (1) collaboration in the advancement of mutual understanding of peoples; (2) encouragement of popular education and the spread of culture; and (3) increase and diffusion of knowledge. The activities of UNESCO have grown in scope and significance since 1946. In recent years UNESCO has emphasized international projects for the reduction of adult illiteracy and for "fundamental education," which refers to the minimum of education required to combat the interrelated problems of illiteracy, ill health, undernourishment, and low productivity confronting the world's underdeveloped regions. It has also instituted programs in Latin America, Asia, and Africa for the expansion of primary education. Other UNESCO activities have included: general cultural projects; scientific problems of international scope, such as arid zone climatology; and encouragement of international travel and exchange student programs.

Another development following World War II was the establishment of the Institute for International Educational Research at Frankfurt, Germany. Under the sponsorship of UNESCO and the American Educational Research Association the first international conference on educational research was held at Atlantic City, N.J., in February 1956.

The Food and Agricultural Organization of the United Nations (FAO, q.v.) provides fellowships for senior technical personnel working in the fields of agriculture, forestry, home economics, and related subjects. The World Health Organization (WHO, q.v.), a specialized agency of the U.N., has an elaborate program for the promotion of health education, involving fellowships and arrangements with colleges and universities in many countries.

United States Government Programs.—After World War II three important congressional acts gave a new impetus to international exchanges in education. The Fulbright Act of 1946 provided that some of the currencies and credits of other countries acquired by the United States through the sale of surplus property abroad might be used for educational exchanges. Mature scholars, as well as younger students, have been able to enjoy the benefits of foreign study under this act, which was supplemented by the Smith-Mundt Act of 1948 and the Mutual Educational and Cultural Exchange Act of 1961. The Institute of International Education cooperates with the Department of State in the administration of these and other special government exchange programs.

The international education exchange program was born of faith in the American way of life and conviction that exchanges with other free nations lead to mutual understanding and respect. Through this program the United States government has sought to strengthen the security of the free world, in a climate unhealthy to dictatorship and nourishing to the growth of democracy.

The Agency for International Development (AID) was established in 1961 as an agency within the Department of State. One of its functions is to assist less developed countries to promote economic development, with emphasis on education through programs of technical cooperation. Much of the training given under the program is the responsibility of American and foreign colleges and universities, which administer certain aspects of the program under contract with AID. A number of foreign educational institutions and systems receive direct support from AID. The overseas information program of the United States Information Agency (USIA) is also involved in international education, for it is intimately connected with the curricula and activities of universities abroad. Often an affiliation between an American and a foreign university has been facilitated by the USIA.

The Peace Corps, established in 1961 as an agency within the Department of State, provides skilled manpower to newly developing nations. Peace Corps volunteers teach or perform other assigned duties in the communities to which they are sent.

Several constituent agencies in the Department of Health, Education, and Welfare administer programs in the field of international education. Some of these activities are carried out under agreements with AID or the Bureau of Educational and Cultural Affairs within the Department of State. The programs of the Office of Education include such activities as teacher exchange between the United States and other countries, and research and dissemination of information abroad. The Office of Education contains a Bureau of International Education consisting of a Division of International Studies

and Services and a Division of Technical Assistance and Exchange Programs.

Nongovernmental Programs in the United States.—Privately supported educational institutions, foundations, religious organizations, and other nongovernmental agencies provide schools and universities, books and libraries, welfare services, hospitals, and thousands of well-trained American personnel for humanitarian, scientific, and academic services abroad. Hundreds are sending materials and information abroad, exchanging persons, and carrying on other types of projects important to the task of promoting international understanding.

American foundations play an increasingly important role in the educational relations of the United States with foreign countries. The foundations administer large funds and often set the pattern for the programs of other private organizations. Ford Foundation fellowship grants have provided opportunities for American scholars to study in all parts of the world.

Although practically throughout their history American religious organizations have been active in other countries, since World War II the significance of their activities has grown in relation to the goals of international education. While endeavoring to spread Christianity in non-Christian countries, Protestant and Catholic churches have been active in the establishment of schools, colleges, hospitals, and other centers that have contributed to the advancement of education. American Jewish organizations have joined the Christian churches in the development of educational facilities abroad.

Other American nongovernmental organizations now active in the field of international education include professional and service organizations such as the American Council of Learned Societies, several commissions and committees of the American Council on Education, the American Library Association, the Institute of International Education, the National Academy of Sciences, the National Education Association, and the Social Science Research Council.

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INTERNATIONAL EXCHANGE. See BANKS AND FINANCE—17. *World Trade and World Finance* (Foreign Exchange).

INTERNATIONAL FALLS, city, Minnesota, county seat of Koochiching County, situated 165 miles northwest of Duluth. The city is located on the south bank of the Rainy River, which here forms the American-Canadian international boundary. A bridge connects it with Fort Frances, Ont. A port of entry, it has a customs house and is a station of the United States International Border Patrol. International Falls is the center of a truck-farming and dairying region,

producing clover, alfalfa seed, potatoes, and vegetables. Manufactures include newsprint, paper products, insulite, and butter. Founded in 1881 by Alexander Baker, it was incorporated as a village in 1901 and as a city in 1910. It is governed by mayor and council. Pop. 6,778

INTERNATIONAL GEOPHYSICAL YEAR (IGY). The International Geophysical Year was the third in a series of "International Years" devoted to a study of the physics of the earth. Its predecessors, the First International Polar Year of 1882-1883 and the Second International Polar Year of 1932-1933, were concerned primarily with the Arctic; the IGY emphasized the entire globe.

The IGY covered a time period of 18 months (July 1, 1957 to Dec. 31, 1958), which was chosen to coincide with a maximum of solar activity. The study, in the 11 scientific fields of geophysics, constituted the most extensive examination of the planet earth yet made—from its deep interior outward into interplanetary space. To carry out the endeavor, over 4,000 geophysical stations, 80 oceanic research vessels, and 10,000 scientists were involved.

The IGY was administered under the auspices of the International Council of Scientific Unions (ICSU), which established a Comité Spécial de l'Anne Geophysique International (CSAGI) to supervise and integrate the effort. In addition to instituting a comprehensive program of geophysical observations, the IGY evoked a spirit of cooperation among the 66¹ participating nations that is unique in international relationships.

Although the IGY officially terminated on Dec. 31, 1958, the enterprise continued on a more limited scale as International Geophysical Cooperation 1959 (IGC-59). The success of the IGY prompted ICSU to create several new committees to coordinate future research: Committee on Space Research (COSPAR); Special Committee on Antarctic Research (SCAR); Special Committee for Oceanic Research (SCOR); and International Geophysical Committee (CIG). Also, a "little IGY" has been proposed for 1964-1965, during the next period of minimum solar activity.

The broad objective of the IGY was a more complete knowledge of the characteristics of the earth and its environs. To meet this goal, it was necessary to obtain simultaneous measurements, from many places on earth, of the weather, ocean conditions, the aurora, the ionosphere, the earth's magnetic field, etc. The observations not only provided an instantaneous picture of, for example, weather or the ionosphere over the

globe, but also will serve as a basis for detecting long term changes in slowly varying phenomena (for example, glacial mass, carbon dioxide content of the atmosphere, temperature of the earth). To study solar influences on the earth, an alerting system was established to notify participating countries that certain observations should be intensified. The "alerts" were issued whenever the Boulder, Colo., analysis center believed that changes in the upper atmosphere could be caused by a solar flare or other active solar conditions.

The tremendous quantities of data amassed by the IGY were deposited in three World Data Centers. Data Center A is located in the United States, B in the USSR, and C is divided among western Europe, Australia, and Japan. Each center will store a complete set of the IGY observations, and will make these data and working space available to researchers.

Some broad results of the IGY are: (1) the promotion of greater scientific cooperation among scientists and nations; (2) the erosion of specialization and the consequent cross fertilization of the geophysical sciences; (3) the large scale use of cosmic rays as a geophysical tool; and (4) clarification of terrestrial events following certain solar flares. The IGY stimulated geophysics, fostered a well planned scientific invasion of Antarctica, and advanced the responsible scientific exploration of space.

Under the aegis of IGY and IGC-59, many technological "firsts" took place: launching of an artificial satellite (Sputnik I, Oct. 4, 1957); compilation of complete Antarctic weather maps; launching of lunar and space probes; transarctic submarine passage via the North Pole (*Nautilus*, Aug. 3, 1958); modification of outer space by a nuclear detonation (Project Argus, Aug. 30-Sept. 3, 1958); rocket observations during a solar eclipse (Danger Islands, Oct. 12, 1958); attainment of the moon by an unmanned rocket (Lunik II, Sept. 13, 1959) and photographs of the unknown face of the moon (Lunik III, Oct. 5, 1959).

Satellites and Space Probes.—Satellite vehicles of various sizes and complexity were orbited by the United States and the USSR. The scientific successes of the early satellites led to direct probings in the vicinity of the moon and in interplanetary space at great distances from the earth.

The satellites and space probes provided information on the temperature and density of the upper atmosphere, the charged particle concentrations above the ionosphere, the meteor density in space around the earth, the rate of decrease of the earth's magnetic field, the intensity of cosmic radiation, etc. They also allowed the discovery of the crescent-shaped radiation zones encircling the earth and roughly pointing at the geomagnetic poles (Van Allen radiation belts, q.v.). These belts contain ionized particles of rather high energy and constitute a region of intense radiation whose maximum is found over the geomagnetic equator.

Observations on the deceleration of artificial satellites indicated that the mean value of atmospheric density at altitudes above 225 kilometers (km.) is about 10 times greater than previously estimated. The density of the outer atmosphere seems to be half as large in June as in December. The cause may, perhaps, be traced to the difference in positions of the earth in its orbit. Electron concentrations above the maxi-

¹The 66 participating nations were: Argentina, Australia, Austria, Belgium, Bolivia, Brazil, Bulgaria, Burma, Canada, Ceylon, Chile, China (Taipei), Colombia, Cuba, Czechoslovakia, Denmark, Dominican Republic, East Africa, Ecuador, Egypt, Ethiopia, Finland, France, German Democratic Republic, German Federal Republic, Ghana, Greece, Guatemala, Hungary, Iceland, India, Indonesia, Iran, Ireland, Israel, Italy, Japan, Korean Democratic Republic, Malaysia, Mexico, Mongolian Peoples Republic, Monaco, Netherlands, New Zealand, Norway, Pakistan, Panama, Peru, Philippines, Poland, Portugal, Rhodesia and Nyasaland, Rumania, Spain, Sweden, Switzerland, Tunisia, Union of South Africa, United Kingdom, USSR, United States, Uruguay, Venezuela, Vietnam Democratic Republic, Vietnam Republic, and Yugoslavia.

Although China (Peiping) withdrew from the IGY in protest at the inclusion of China (Taipei), a large geophysical program was instituted. The meteorological network was expanded from 50 to 1,500 stations; geophysical observatories were established at Lanchow, China, and Lhasa, Tibet, and research in many geophysical fields, including oceanography, undertaken.

mum of the F ionic layer were found to decrease about six times more slowly than the increase from the bottom of the ionosphere to the F layer maximum at 300 km. At 1,000 km., the atmospheric number density is about 7×10^{10} per cm.³

Several hundred ions per cm.³ surround the earth from high in the atmosphere to about 14,000 miles after which the density drops. This highly rarified outer atmospheric "geo-corona" is probably hydrogen, and probably originated in water evaporated from the oceans and subsequently dissociated high in the atmosphere by sunlight.

Deductions from satellite measurements revealed that the earth is very slightly pear shaped (with the stem end near the North Pole), and that it does not bulge at the equator to the extent hitherto expected. The moon probe, Lunik III, showed that the moon possesses a weak magnetic field, if any, and is not enveloped by radiation belts as is the earth. Ion concentrations increased within some 10,000 km. from the moon. Photographs of the hitherto unseen side of the moon (made 37,000 to 41,000 miles above the surface) showed that only about 10 per cent of the far side is covered with "seas" as compared with 30 to 35 per cent of the known side.

Antarctica.—Twelve nations sponsored major scientific expeditions to Antarctica. Discoveries included new mountains, mountain ranges, coal and mineral deposits. From an analysis of seismic waves, Antarctica was found to be mainly continental in character; however, the ice sheet also caps a number of islands. Many long distance surveys making seismic soundings and gravity measurements were completed.

Bore holes were drilled at Little America (850 feet), Byrd (1,400 feet), and Mirny. The international Antarctic Weather Central made detailed analyses of Antarctic meteorology and supplied weather forecasts to all parties. The continent was found to possess 40 per cent more ice than previously assumed. Large volumes of ice extend to the bottom of the sea. Near Byrd, for example, ice 14,000 feet thick lies on bedrock 8,200 feet below sea level. This ice may be the thickest yet measured anywhere. The lowest temperature on earth, -125.3°F. , was registered near the center of Antarctica. Nonflowering plants (algae, lichens, and mosses) were found to have a remarkably wide distribution throughout the ice-free areas.

Arctic.—Four drifting stations were established (A and B by the United States and SP6 and SP7 by the USSR) on the floating ice of the ocean. Stations C and SP8 replaced A and SP7 after they were closed by ice degeneration. Measurements from the floating observatories supplemented those from the fixed land stations, and provided information on ocean bottom topography, water movements, water-ice heat budget, net increase of ice, etc. In addition, data were obtained on the state of the ionosphere, aurora, magnetic field, etc.

Rocks of all shapes and sizes, abundantly scattered about the bottom, appeared to be a general feature of the Arctic Ocean. Little life was found on the ocean floor. However, sponge, shrimp, fish and sea anemone were photographed on a newly discovered underwater plateau about 8,000 feet above the ocean floor.

General.—New ocean currents were found. A counter Gulf stream was located in the Atlantic. In the Pacific, two great currents were mapped:

the equatorial undercurrent and the countercurrent. The undercurrent, larger than the Gulf Stream in volume, is 3,500 miles long, 250 miles wide, lies at a depth between 100-800 feet; flows eastward and disappears near the Galapagos. Of 89 Swiss glaciers studied, 83 receded an average of 48 feet during the IGY—one indication in support of the thesis that the earth is now slowly warming up.

Some displays of the aurorae borealis and australis occurred at the same time. The presence of the equatorial electrojet (an electric current flowing in the atmosphere above 100 km.) was confirmed, as predicted by theory. A new atomic emission at 6700 Å, attributed to lithium generated during nuclear explosions, was detected in twilight spectra.

The most brilliant solar flares that also emitted a characteristic radio noise were found to initiate by three events on earth: (1) a proton shower one to five hours later; (2) a magnetic storm, one to two days later; and (3) a sudden decrease in cosmic ray intensity at or just before the time of the magnetic storm. The most important solar emission lines seem to be those of hydrogen (Lyman alpha, 1216 Å) and helium (singly ionized, 304 Å). Both far outshine all other solar ultraviolet emissions.

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INTERNATIONAL LABOR ORGANIZATION (ILO), an intergovernmental agency of 78 member nations, established in 1919 at the Paris Peace Conference and in 1946 made a specialized agency of the United Nations. The United States joined in 1934.

Organization.—Workers, employers, and governments share in making its decisions and policies, in which respect the organization is unique among international agencies. Each national delegation has four members, one each for the workers and employers and two for the respective governments; each delegate has one vote in the annual conference and other meetings of the organization. This tripartite structure gives the ILO its balance and much of its strength.

The chief purpose of the ILO is to improve-labor conditions and raise living standards. Operating from headquarters in Geneva, Switzerland, and through various branch and field offices scattered throughout the world, it functions through three principal organs: (1) an International Labor Conference, the supreme body of the organization which provides a world forum for labor and social questions; (2) a governing body, the executive council, which is composed of 20 government, 10 management, and 10 labor representatives; and (3) an International Labor Office, the secretariat, which serves as an operational headquarters, a world information center, and a publishing house. In 1957, the chief executive officer was the director general, David A. Morse, who was a former United States undersecretary of labor.

Program.—Since mid-20th century, the ILO has emphasized its operational programs such as technical assistance. Through the combined funds provided under its regular budget and through the United Nations Expanded Technical Assistance Program, the ILO provides governments with expert advice and technical assistance in matters connected with labor and social policy.

By the end of 1956, it had sent more than 650 technical assistance experts to Asia, Latin America, Africa, the Middle East, and elsewhere, helping less developed countries with the many problems of industrial and agricultural expansion.

Field offices have been established in various parts of the world to serve as centers for assistance to governments in such matters as vocational training, increasing productivity, building up employment services, and encouraging the development of handicrafts and cooperatives. In addition, the ILO has awarded more than 1,375 fellowships and study grants to underdeveloped countries and placed more than 800 workers and foremen for practical on-the-job training in factories abroad.

A major project of the organization is the eradication of forced labor from the world. In 1957, a convention with this aim was in the process of adoption following concentrated study by an *ad hoc* committee appointed to uncover this social evil imperiling freedom of association and the individual liberties of workers.

Work is also being done to improve labor-management relations throughout the world. Increased attention is being given to the economic and social effects of automation, the industrial use of atomic energy, and discrimination in employment.

Through research and investigation, the ILO continues to assemble current information concerning the world labor market and the various important developments which can provide the basis for better working and living conditions of the world's population.

Since 1945, the ILO has established eight industrial committees to aid in solving the social and economic problems peculiar to particular industries. These are now organized for coal mining, textiles, construction, iron and steel, the metal trades, inland transport, petroleum production and refining, and the chemical industry. A large number of commissions and committees have also been set up to study occupational health and safety, the employment of women, social security, and the problems of white collar workers.

Standards.—In the years since its organization, the ILO, through the adoption of more than 100 conventions and numerous recommendations, has written an International Labor Code. This code of conventions and recommendations deals with unemployment, weekly rest periods, maternity protection, maritime working conditions, the right of workers to organize, and the right to bargain collectively, among many others.

Member countries agree to examine each convention for possible ratification and to report to the ILO from time to time concerning the state of local law and practice. Thus, ILO conventions influence standards even in countries where they have not been ratified. Recommendations do not require ratification.

Through all its various programs, the ILO aims at putting peace on a solid base of social justice. Its motto is: "Poverty anywhere is danger to prosperity everywhere." See also CHILD LABOR—*International Movements for Regulation*; COLLECTIVE BARGAINING—*International Aspect*.

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INTERNATIONAL LANGUAGE. See UNIVERSAL LANGUAGE.

INTERNATIONAL LAW, a term usually defined as that body of rules, principles, and standards to which independent states are bound by common consent. This definition assumes that the source of international law is the consent of those bound and that its sanction is good faith.

SOURCES AND SANCTIONS

The lack of coercive sanctions has induced some writers to assume that international law has the character of morality rather than of law. There are, however, other sanctions and other sources of international law. Thus, in addition to the sanctions of good faith, of foreign office habituation, of national self-interest, and of world opinion, international law is sanctioned by the probability of retaliatory action by the state injured by its violation and, in recent times, by the activity of international agencies in organizing positive sanctions in case of serious violations. The effectiveness of these sanctions has varied during the past five centuries, according to the stability of the balance of power, the efficiency of international organization, and the adaptation of international law to changing conditions. The interests of states have been influenced by the progress of technology and the development of new ideologies, by the rise of new nations and the disintegration of empires, by the political and industrial revolutions, and by the increase of economic and political interdependencies among states. International law has often lagged behind changes in the interests which it seeks to protect resulting from such new conditions.

Even under the most favorable conditions, the sanctions of international law have been less reliable than the procedures and forces usually available to national governments to apply and enforce the law of the state. In recent times, in spite of the improvements in "international organization" and the abundance of "international legislation," the rapidity of technical, social, political, and economic change has been such that changes in international law have not kept pace. The reliability of international law can be increased both by legislative procedures to keep it up to date and by judicial and executive procedures to apply and enforce it in particular cases. Because of the accepted principle that a state cannot be bound by a new rule of international law without its consent, the problem of developing adequate legislative procedures in a rapidly changing world presents great difficulty—a difficulty not entirely obviated by the greatly improved procedures which have been developed during the past years.

The sources of international law are also broader than expressed consent. Thus the Statute of the International Court of Justice provides as follows:

The court, whose function is to decide in accordance with international law such disputes as are submitted to it, shall apply:

- (a) international conventions, whether general or particular, establishing rules expressly recognized by the contesting states;
- (b) international custom, as evidence of a general practice accepted as law;
- (c) the general principles of law recognized by civilized nations;
- (d) subject to the provisions of Article 59, judicial decisions and the teachings of the most highly qualified publicists of the various nations, as subsidiary means for the determination of rules of law.

Article 59 declares that "the decision of the court has no binding force except between the

parties and in respect to that particular case." In a broad sense the four sources resemble those of national law systems, usually summarized as agreement, custom, reason, and authority; however, the authority of judges and publicists to make and interpret law for the community of nations is very different from the authority of legislative bodies and courts to make and declare law within modern states.

International law, therefore, differs considerably in both its sanctions and its sources from systems of national law, but the difference is one of degree rather than of kind. International law has been observed by the states subject to it and applied by their courts in suitable cases, except when an emergency situation or a new condition has convinced the government that observance would adversely affect a vital national interest. Such situations and conditions have, however, been frequent in the 20th century. A system of law is effective in proportion to the solidarity and integration of the society in which it functions. Since the society of nations is highly decentralized and incoherent, international law has been imperfectly effective and will remain so until individuals and governments identify themselves and their interests with that society in greater degree, permitting a greater centralization of international institutions.

HISTORICAL SURVEY

In a broad sense international law has existed whenever independent political groups have come into regular contact with one another. Thus, most primitive peoples recognize rules applicable in their relations with neighboring tribes. The ancient Greek city-states, the Mediterranean states of the Hellenistic period, the states of Confucian China, and the states of ancient India, each constituted a "society of nations" which recognized many rules regulating the intercourse of the members. In the Middle Ages, princes, nominally subject to feudal superiors, pyramiding up to the emperor and the papacy, increasingly accepted practices concerning diplomatic representation, maritime commerce, treaty interpretation, and war. Philosophical discussions distinguished just from unjust war, and recognized limitations upon the waging of war, some of them learned by Christendom from the Saracens during the Crusades.

Origin of Modern Concepts.—It was not, however, until the breakup of the medieval system and general acceptance of the concept of territorial sovereignty in the 15th century that international law began to assume a systematic character. The speculations of medieval theologians and philosophers, the practices of the Italian states in the late Middle Ages, the writings of Renaissance political scientists like Niccolò Machiavelli and Jean Bodin, the practices of contemporary sovereigns, and particularly the classical concept of "natural law" were drawn on by a body of writers whose works have been translated and published in recent years by the Carnegie Endowment for International Peace under the title *The Classics of International Law*. These writers of the 16th, 17th, and 18th centuries are divided into three schools—the naturalists, who emphasized the moral and rational principles of "natural law," the positivists who emphasized custom and agreements, and the eclectics who gave weight to both, as does the Statute of the International Court of Justice.

Among the naturalists were members of the 16th century Spanish school, Francisco de Vitoria (1480?-1546) and Francisco Suarez (1548-1617), and the 17th century German, Baron Samuel von Pufendorf (1632-1694). Vitoria's treatises were compiled from lectures which he gave at the University of Salamanca in 1532, inspired by the recent conquest of Mexico by Hernán Cortés. He inquired into the right of the Spanish sovereigns to conquer princes of the New World, and was thus led to set forth a system of rules based upon "natural law" which alone, he thought, could govern the relations of sovereigns of widely different culture and religion. Pufendorf was influenced by the British political philosopher, Thomas Hobbes, who taught that man in a "state of nature" is bound only by the "natural right" of self preservation, and that the absence of a sovereign authority to enforce law led to a state of war of all against all. He considered sovereign princes to be in this situation, although reason would urge acceptance of rules of "natural law" such as the observance of agreements, and the establishment of authority to enforce them. Pufendorf was more optimistic about the nature of princes, and felt that reason, embodied in natural law, would be in a measure self-executing.

Among positivists were the Italian jurist, Alberico Gentili (1552-1608), who became an adviser of Queen Elizabeth I; the English judge, Richard Zouche (1590-1661); the Dutch judge, Cornelis van Bynkershoek (1673-1743), who is distinguished for proposing the three-mile limit for a state's territorial waters; and the German jurist, Johann Jakob Moser (1701-1785).

The leading eclectic was Hugo Grotius (q.v.), a Dutch jurist, theologian, and philosopher, often called the father of international law. His famous treatise on *The Law of War and Peace* appeared in 1625, during the early part of the Thirty Years' War and was in part inspired by the desire to mitigate the barbarities of that war. The philosopher, Baron Christian von Wolff (1679-1754) and Emmerich Vattel (1714-1767) wrote in the mid-18th century, the first emphasizing the great society, or *Civitas Maxima*, as the source of authority for international law, and the latter the balance of power as the condition which sanctioned it. While often called eclectics, these two writers should, perhaps, be classed with the naturalists because, in principle, they deduced international law from reason, which taught, according to Vattel, that agreements, whether expressed, tacit, or implied, should be observed. These classical treatises were all in Latin except that of Vattel, who wrote excellent French—perhaps accounting for the very wide publicity given to his treatise particularly among the constitutional founders of the United States. The leading American international lawyer of the 19th century, Henry Wheaton (q.v.), based his treatise in large measure upon Vattel.

In the 19th century a very large number of writers in all languages wrote on international law largely from the eclectic or positivist point of view. Among naturalists the outstanding writer in the English language was the Scot, Sir James Lorimer (1818-1890), whose treatise appeared in the 1880's. The best known recent treatises in English are those by Lassa Oppenheim (1858-1919), late professor at Cambridge University, and Charles Cheney Hyde (1873-1952), late professor at Columbia University. In

recent times, rapidly changing conditions have led international jurists to explore basic principles of psychology, sociology, and politics, as well as of ethics, to discover the rules and principles best adapted to the emerging situation, thus reviving the idea of natural law, but with a more evolutionary connotation than was attributed to that term by the classicists. The emergence of this school has led to a distinction between "the new international law," which emphasizes principles based upon the values expressed in general treatises and declarations and the practical requirements of the situation, and "traditional international law," which accepts only concrete rules established by custom (especially those established before World War I) or by formally ratified treaties. Advocates of both points of view seek to formulate the law in general statements equally and reciprocally binding on all parties to a controversy.

Periods of Development.—The history of modern international law can be conveniently divided into five periods separated from one another by great wars. The first period, from the discovery of America and the development of powerful monarchies in Spain, France, and Britain in the late 15th century to the Peace of Westphalia (1648) ending the Thirty Years' War, was characterized by the establishment of territorial sovereignty as the basic principle of international relations. The wars of religion, precipitated by the Reformation early in the 16th century, were ended by acceptance of the formula *cuius regia eius religio*. It was recognized that each secular prince could determine the religious problems within his domain. During this period, the classical writers of international law established doctrines, often based on principles of Roman law identified with "natural law," concerning acquisition of territory, demarcation of boundaries, diplomatic privileges and immunities, rules concerning treaty negotiation and interpretation, and principles concerning the initiation and conduct of war.

The second period extended from the Peace of Westphalia (1648) to the Peace of Utrecht (1713), ending the War of the Spanish Succession, and was characterized by recognition of the balance of power as the principle of European politics and the condition of a reliable international law. This principle was relied upon by England to justify its intervention in the wars of Louis XIV and was later defined by Talleyrand as "a combination of the mutual rights and interests of the powers, by means of which, Europe aims at securing the following objects: (1) that no single power, nor any union of powers shall have mastery in Europe; (2) that no single power nor union of powers shall be able to infringe the actual possession and recognized rights of any other power; (3) that it shall no longer be necessary, in order to maintain the established state of affairs, to live in a state of imminent or actual war, and that the proposed combination shall secure the peace and repose of Europe against the efforts of a disturber by diminishing his chances of success." During this period, the European states engaged in much overseas exploration and settlement, testing principles concerning territorial acquisition and establishing the freedom of the seas beyond territorial waters. Many treaties were made recognizing neutral rights of commerce in time of war.

The third period from the Treaty of Utrecht

to the Treaty of Vienna (1815), ending the Napoleonic Wars, was characterized by a great deal of naval war for trade routes and overseas territory, and the rise of nationalism and democracy in the American and French revolutions. As a result of the revolutionary ideologies, the concept of the state changed from the domain of an absolute monarch to a corporate body governing itself within a territory. The law of maritime war and the rights and duties of neutral states were developed during this period. International law in these matters was given a new precision through treaties, the judgments of prize tribunals, the judicial enforcement of neutral obligations, and the judicial recognition of diplomatic immunities. Ideas of international organization developed during the period through theoretical writings and were given limited application in practice through the system of guarantees and conferences set up by the treaties ending the Napoleonic Wars. In the latter part of the period, certain diplomatic, economic, and social problems such as the ranking of diplomatic representatives, the navigation of international rivers and straits, and the elimination of the slave trade were dealt with by general treaties, thus initiating the modern era of "international legislation."

The fourth period, from the Treaty of Vienna to the Treaty of Versailles (1919), was distinguished by the Industrial Revolution; great increases in wealth and population, especially in Europe and America; the shrinking of the world through new means of transportation and communication; and, under the dominance of British sea power and finance—the *pax Britannica*—the least war in Europe since the *pax Romana* of the 2d century A.D. It was marked by the great development of diplomatic and consular systems, by the extensive use of arbitration to settle international disputes, by the rise of nationality as a political principle, and by the operation of the "concert of Europe" to maintain an equilibrium of power and to deal collectively with political problems such as those faced in the disintegration of the Turkish Empire, the weakness of China, and the partition of Africa. The development of the United States and Japan as great powers outside of Europe; the recognition of Latin American, Asiatic, and African states as members of the society of nations; and the development of international unions and international legislation made the society of nations worldwide and strengthened its political and administrative organization. The international unions dealt with postal, telegraphic, and radio communications; with railroads and river and oceanic transportation; with commerce, migration, and health; and with problems of slavery, narcotic drugs, and war.

Particularly notable for international law during this period was the codification of basic principles of maritime international law in the Declaration of Paris (1856) and the unratified Declaration of London (1909). The codification of the law of land warfare was initiated in Francis Lieber's *Code for the Government of Armies* (1863), which was issued for the Union armies during the American Civil War, the most serious war of the period in the West. It was carried on internationally in the Geneva Red Cross Convention (1864), the Declaration of St. Petersburg (1868), and The Hague Conventions (1899, 1907). The latter included conventions on both land and maritime war and began to deal with aerial war by a declaration prohibiting the drop-

ping of explosives from balloons or aircraft. Declarations and conventions also dealt with gas warfare, the use of submarine mines, and naval bombardment. These extensive and, for the most part, widely ratified codifications defined the rights and duties of belligerents and neutrals with considerable precision and were generally observed during World War I.

Increasingly, as invention produced weapons of great striking power and mobility, jurists gave attention to the problem of eliminating or decreasing the probability of war through methods of pacific settlement. Arbitration, which had been used by the ancient Greeks and in the Middle Ages, was re-established by the Jay Treaty between Great Britain and the United States (1794), and some 400 international arbitrations were held during this period, notably the Alabama (1871) and Bering Sea (1894) arbitrations between the United States and Great Britain. Treaties for the future submission of disputes to arbitration were made and The Hague Conferences produced the Convention for the Pacific Settlement of International Disputes, which recognized the interest of third states in preventing hostilities, urged that they tender good offices to this end, provided for mediation and commissions of inquiry, set forth a code of arbitral procedure, and urged conclusion of treaties obliging the parties to arbitrate justiciable disputes. This convention also established a panel of arbitrators with administrative headquarters at The Hague, known as the Permanent Court of Arbitration. Several disputes were settled by recourse to this court and, at the Second Hague Conference, a Court of Arbitral Justice and an International Prize Court were proposed as permanently sitting tribunals. This effort was not realized until after World War I, but the Central American Court of Justice with jurisdiction over the five Central American republics was established in 1907 as the first genuine international tribunal of modern times.

In spite of the development of international law and the rise of pacific settlement during this period, it was clear that the balance of power was becoming less stable and that the destructiveness of weapons was making war more serious. The czar's prime purpose in calling The First Hague Conference was to reduce the prospects of war by disarmament and pacific settlement. No progress was made in disarmament nor was arbitration made obligatory, and the bipolarization of power through the development of two great alliance systems in Europe at the turn of the century augmented the arms race and led to World War I. Experience with the purely voluntary Hague system led, after that war, to the establishment of the League of Nations designed to put teeth in that system by preventing or stifling aggression, assuring pacific settlement, and establishing international law, through collective action of the members.

The fifth period, beginning after the Treaty of Versailles, is covered below, under the section *International Law Since World War I*.

INTERNATIONAL LAW SINCE WORLD WAR I

The final period in the history of international law from the Treaty of Versailles to the present time has been characterized by the functioning of the League of Nations and the United Nations; by acceleration in the breakup of empires and the self-determination of nations; by the rise

in importance of Asiatic and African states in international politics; and by the accelerated utilization of aviation, electrical communication, and nuclear energy—thereby shrinking the world, rendering all states vulnerable to sudden attack, and increasing the destructiveness of war. The period has also witnessed an extraordinary increase in international legislation and administration to serve economic, social, and humanitarian interests, and the emergence of the human rights of individuals and the self-determination of nations as basic interests of the world community. The consolidation of the society of nations founded upon international law stimulated the emergence (among those dissatisfied with the status quo) of opposing aggressive ideologies of fascism, nazism, and communism challenging the ideology of democratic, humanistic nationalism. This challenge resulted in World War II, in which democracy allied itself with communism to exterminate fascism and nazism. This was followed by the cold war between democracy, led by the United States, and communism, led by the Soviet Union. These events have led to reappraisals of international law from the points of view both of content and of enforcement with the hope of narrowing the gap between the asserted values and the actual practices of sovereign states.

The various factors influencing international relations during the past century have resulted, on the one hand, in the rise of nationalism, consequent upon more extended literacy, democracy, and centralization of national political and economic authority; and on the other hand, in the development of internationalism, consequent upon inventions which have expedited world communications, travel, and transport, increased international trade, and developed international organization. In 1894, the distinguished French publicist Henri Bonfils wrote: "Public international law proposes to reach a compromise between two actions contrary in fact, that of the principle of autonomy of states, and that of the notion of the cosmopolitan society. Neither of these two principles ought to supplant the other, nor to be put completely to its practical application." (*Manuel de droit international public*, section 24, p. 10, Paris 1894; 6th ed., Fauchille 1912.) These two tendencies have each been exaggerated by the factors referred to and as a result the task of international law in compromising them has become more difficult. That difficulty has been reflected in the rapid oscillation between wars of extreme violence and institutional constructions of extraordinary scope which have characterized international life since 1914.

Nationalism, nurtured in 19th century ideas of liberalism, was affected by protectionist pressures of business, by socialistic pressures of labor, by imperialistic pressures of politics, by militaristic necessities in waging war, and by the defensive urge to acquire invulnerability from blockades after World War I. As a result, nationalism developed among the politically less experienced people of Europe into fascism, nazism, or communism, creating totalitarian states with control of government, economy, religion, and opinion centralized in irresponsible dictators intent on continually expanding the sovereignty, self-sufficiency, military power, and living space of the national group. Nationalism of this form, equipped with such modern devices

as the airplane, the submarine, heavy mobile artillery, machine guns, conscription, propaganda, and controlled economy has given war a totalitarian character, regimenting the population and subjecting civilians to hardships unparalleled in history. Whether the hydrogen bomb will reinforce this tendency or—by the very magnitude of its threat—will revolutionize the world order, remains to be seen.

The totalitarian states in their early history avowed new concepts of international law. The conceptual repudiation of established international law by fascist, nazi, and communist governments tended to decline, in proportion as these governments entered into relations with others and were confronted with the need to solve international problems; however, in practice, these states manifested an extreme propensity to neglect the rules of international law. Other states have also departed from established law, partly in retaliation and partly in adapting themselves to changed technical conditions.

During World War I, certain weaknesses in international law were recognized, particularly (1) the lack of a legal interest of third states in the observance of international law when their own immediate interests were not involved; (2) the emphasis on international rights rather than international responsibilities; (3) the lack of a legal obligation of states to accept external judgments in their controversies; and (4) the lack of an international organization to represent the general interest in law observance, to provide for impartial adjudication of disputes, and to enforce responsibilities under international law. It was hoped that the peace ending World War I would remedy these deficiencies.

Thus, with respect to the legal interest of states, Elihu Root said in 1915: "If the law of nations is to be binding, if the decisions of tribunals charged with the application of that law to international controversies are to be respected, there must be a change in theory, and violations of the law of such character as to threaten the peace and order of the community of nations must be deemed to be a violation of the right of every civilized nation to have the law maintained and a legal injury to every nation. . . . Wherever in the world the laws which should protect the independence of nations, the inviolability of their territory, the lives and property of their citizens, are violated, all other nations have a right to protest against the breaking down of the law. Such a protest would not be an interference in the quarrels of others. It would be an assertion of the protesting nation's own right against the injury done to it by the destruction of the law upon which it relies for its peace and security." ("The Outlook for International Law," *Proceedings of the American Society of International Law*, 1915.)

With respect to international responsibilities the present writer wrote in 1919: "Thus, though international law must continue to aim at preserving the independence and autonomy of states, it must assume that its own preservation is more important. It follows that international law can no longer be conceived by text writers as a series of deductions from an assumed 'fundamental right of states to exist.' The responsibility of states to assure the existence of the law will have to be conceived as even more fundamental. . . . States cannot survive where sovereignty can override the law." ("Effects of the

League of Nations Covenant," *American Political Science Review*, November 1919.)

With respect to the right of self-judgment, and the need of international organization, John Bassett Moore wrote in 1915:

"If states do not succeed (in gaining redress for injuries by amicable modes) it is laid down that they may try inamiable methods, ranging all the way from retorsion to retaliation, embargo, commercial nonintercourse, severance of diplomatic relations, and display of force, to reprisals, which are acts of war, and to war itself, which is in its physical aspect merely general reprisals. Nevertheless, if actual force be employed, there is always the danger of forceful resistance, ending in war; and in that event we may have the incongruous result that the aggressor, without submitting to the examination of any tribunal the justice of his cause, may, in the exercise of the 'rights of war,' conquer or destroy the injured power which he has by his own wrong driven to become his adversary. This principle, which I conceive to be the capital defect of international law at the present day, is perhaps to be explained as the survival of the superstition that was preserved in municipal law for so many centuries, the process of trial by battle. However this may be, it is flagrantly at variance with all conceptions of human right, and can be effectually got rid of only through further organization. It is in this respect, as I have intimated, that international law differs from municipal law—not in its essence or its obligation, but in the method of its declaration and administration. Within the state we have an organization for the making, declaration and enforcement of law, whereas, as between nations, we are obliged to a great extent to rely upon their voluntary concurrence or cooperation. In other words, we lack in the international sphere that organization which gives to the administration of law within the state a certain security. This defect it is the business of nations to supply by forming among themselves an appropriate organization. The essential features of such an organization would be somewhat as follows: (1) it would set law above violence: by providing for the enforcement of law; and by making the use of force illegal, except in support of a duly ascertained legal right, or in self-defense . . . , (2) it would provide a more efficient means than now exists for the making and declaration of law . . . , (3) it would provide more fully than has heretofore been done for the investigation and determination of disputes by means of tribunals, possessing advisory or judicial powers, as the case might be Occasional disturbances such as these (domestic insurrections) should by no means lessen our estimate of the importance of organization for the maintenance of law, either international or internal. They should on the contrary serve to emphasize, not only the necessity of organization, but also the importance of extending its scope and increasing its efficiency." ("Law and Organization," *American Political Science Review*, February 1915.)

Changes in the Law of War.—The rules of war and neutrality, accepted by custom and by the great lawmaking conventions of the 19th and early 20th centuries, have been greatly modified in practice and perhaps in theory. Among such practices may be noted belligerent (1) internment of enemy civilians, (2) bombardments, (3) destruction of merchant vessels, (4) proclamation of war zones, (5) controls of neutral commerce, and (6) utilization of neutral territory. Neutrals have also resorted to new practices, such as, (7) renunciation of trading privileges, and (8) proclamation of peace zones on the high seas.

(1) While in the past, enemy civilians were sometimes expelled from belligerent territories, they were usually allowed to remain unmolested or given a period of grace in which to wind up their affairs and leave. Since World War I, however, enemy civilians have been interned and treated substantially as prisoners of war by most belligerents. Persons liable to military service have been taken from neutral vessels on the high seas and made prisoners of war. In short, civilians formerly of little military importance are now regarded as a military asset to their country, if not on the front line, then as workers in military production, and they have been treated accordingly by the enemy.

(2) Bombardments by land artillery were formerly confined to the armed forces or to defended towns, though in naval war the right of bombarding military objectives on land was recognized. Aviation has opened new fields to bombardment, and while in principle bombardment for terrorization of civilian populations is considered illegitimate, it occurred especially in the Spanish Civil War and in all theaters of World War II, culminating in the destruction of Hiroshima and Nagasaki by two atomic bombs. Bombardment of military objectives from the air was recognized as legitimate in the Draft Articles of 1923, prepared by experts in pursuance of a Washington conference resolution. Since railroad centers, docks, and factories in densely populated communities may come under this designation, since the aim of bombers, driven up several miles by anti-aircraft defenses, cannot be very accurate, and since the area of direct destruction and poisonous "fallout" of atomic bombs is large, the risk to civilians is very great, even if the law is observed. The threat of aerial bombardment has undoubtedly increased the diplomatic power of a government, suspected of ruthlessness and equipped with a considerable air force. With the increasing range, speed, and capacity of aircraft, the development of rockets, and augmentation of the power of bombs culminating in the hydrogen bomb, defenses against the bombing of civilians and industries in any part of the world have been reduced to the fear of retaliation.

(3) In the conduct of commercial warfare, the sinking of prizes has always been considered an exceptional act permitted only in case of necessity, after the passengers and crew have been placed in safety. The submarine, incapable of sparing prize crews and vulnerable to attack by defensive armaments on merchant vessels, has proved unable to engage in commercial warfare under these rules. An unratified convention of the Washington Conference of 1922 declared that, as a consequence, submarines could not engage in commercial war. Generally ratified provisions of the London Naval Treaties of 1930 and 1936 reiterated the old rule about safety of passengers and crew. Nevertheless, both belligerents, though parties to these conventions, engaged in submarine sinkings in the war of 1939-1945.

(4) The principle of freedom of the seas has meant for over two centuries that in time of war, merchant shipping is free to utilize all sea areas beyond territorial waters, subject only to acknowledged belligerent rights of visit and search, of capture for carriage of contraband, breach of blockade, unneutral service, or enemy character—subject since 1856 to the rule that free ships make free goods. In wars since 1914, however, belligerents mined vast areas of the sea and proclaimed zones where, on account of mines, submarines, or destroyers, navigation was unsafe. Though neutrals at first protested, they in a measure acquiesced in such actions and, in some cases, forbade their ships to enter zones deemed dangerous. Thus, the American Neutrality Act of 1939 authorized the president to proclaim barred zones, and under it he proclaimed the waters surrounding the British Isles, including the North Sea, such a zone. The act was repealed Nov. 17, 1941. A disposition to tolerate encroachments upon freedom of the seas has been manifested among jurists, as indicated by the Harvard Research in International Law, which permits a belligerent to establish blockade zones extending 50 miles

from the enemy's coast (Articles 1e, 69). After World War II the United States declared vast areas of the Pacific unsafe during atomic bomb tests.

(5) Belligerent extensions of contraband lists, broad applications of the rule of continuous voyage and ultimate destination, and resort to retaliatory measures rendering all trade, direct or indirect to or from the enemy, liable to capture have seriously impaired earlier neutral rights of trade even with other neutrals. But going beyond this, belligerents insisted on a deflection of neutral ships to ports for search and withheld bunker coal facilities from neutral vessels and blacklisted neutral firms, barring them from trade with the belligerent's nationals if they would not stop trading with the enemy. While neutrals at first protested, they have in a large measure acquiesced and, in some cases, have embargoed their own trade in certain commodities with belligerents. Jurists have manifested a certain tolerance for such practices. The Harvard Research in International Law suggested abandonment of the old rules in respect to contraband, and the substitution therefor of an elaborate system of certification of vessels with consent of the belligerents, all uncertified vessels being liable to a high degree of belligerent control (Articles 61, 63).

(6) The inviolability of neutral territory from belligerent operations has been a fundamental rule, although Japan and Russia fought their war in 1904 in Chinese territory. Germany began the war of 1914 with an invasion of neutralized Belgium. Russia in 1939 insisted on bases in Estonia, Latvia, and Finland, and when the latter resisted the demand, began military operations in Finnish territory. Belligerent airplanes frequently cruised over Dutch and Belgian territory before these states were attacked by Germany in 1940. Neutrals in the vicinity of belligerent operations lost all confidence that their territory would be respected.

(7) Aware that efforts to defend their trading rights might lead them into war, neutrals have, to an increasing degree, shown an inclination voluntarily to abandon the exercise of these rights. During World War I, many European neutrals prohibited the trade of their nationals with belligerents in many commodities, and by the Act of 1939, the United States prohibited American ships from trading with belligerents or traveling through proclaimed zones in the theater of hostilities. This act also required transfer of title to all goods shipped from the United States to belligerents in whatever vessels they went. Other neutrals have made similar self-denying ordinances.

(8) Neutrals have in the past insisted that hostilities must not occur in their territorial waters. They have even objected to hovering by belligerent war vessels outside of these waters. Going far beyond this, the American countries in the Declaration of Panama, in October 1939, warned belligerents not to engage in hostile acts in a zone 300 miles or more around the American continents except Canada. This warning was not observed by belligerents, particularly in the *Graf Spee* incident, and the American countries considered possible procedures for making it effective before the Japanese attack at Pearl Harbor involved them in the war. The difficulty of assuming responsibility for actually preventing hostilities in so vast an area has been recognized.

These changes have in practice tended to blur

the distinction between civilians and combatants, and to limit the rights of neutrals, thus extending the range of military action. But even more significant has been the blurring of the distinctions between war and peace, and between belligerents and neutrals. From the ending of the Napoleonic Wars to the beginning of World War I, wars were limited in time, area, and methods. They began and ended at determinable times and included definite belligerents. The Hague Conference of 1907 required that war be begun only by a declaration or an ultimatum with a time limit. There were, it is true, numerous interventions, insurrections, and pacifications, not rising to the dignity of war, but sometimes involving considerable casualties. They were, however, usually conducted by great powers against small or backward peoples, and did not cause serious international disturbance. They were considered police operations in contrast to war, which was regarded as a duel in which the belligerents were equal and must be treated impartially by neutrals.

The extraordinary rise of internationalism, and the extraordinary destructiveness of totalitarian war has, however, shaken the moral, economic, and political foundations of this concept of war as a legitimate and institutionalized procedure. The League of Nations Covenant went far toward abolishing war in the legal sense. "Resort to war" in violation of the Covenant was declared illegal and rendered the aggressor liable to economic sanctions by all members of the League. These members were at the same time bound to assist the victim of aggression (Article 16). Thus the essential feature of war in the legal sense, jural equality of the belligerents and jural impartiality of the neutrals, was eliminated in case war was begun in breach of the Covenant. While the Covenant left gaps through which legitimate war might creep, these were blocked by the Pact of Paris, signed in 1928 and subsequently ratified by nearly all the states of the world. Parties to this instrument "condemn recourse to war for the solution of international controversies, and renounce it as an instrument of national policy in their relations with one another." Furthermore, they "agree that the settlement or solution of all disputes or conflicts of whatever nature or of whatever origin they may be, which may arise among them, shall never be sought except by pacific means." Going even further, the members of the United Nations agree "to settle their international disputes by peaceful means" and to "refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any state, or in any other manner inconsistent with the purposes of the United Nations."

The parties to these instruments proceeded to develop procedures for determining the aggressor and for imposing sanctions. A state engaged in hostilities, which refused to accept an armistice or other conservatory measures proposed by the consulting states, was provisionally considered an aggressor. A definition of aggression to determine ultimate responsibility emerged from the judgment of the Nürnberg Tribunal and proposals of the United Nations International Law Commission: it meant the threat or use of armed force across an internationally recognized frontier, for which a government, *de facto* or *de jure*, is responsible, because of act or negligence, unless justified by a necessity for individual or collective self-defense, by the authority

of the United Nations to restore international peace and security, or by the consent of the state within whose territory armed force is being used. (Q. Wright, "The Prevention of Aggression," *American Journal of International Law*, July 1956.) Sanctions included moral denunciation, application of the "Stimson doctrine" that the aggressor should not acquire any legal titles by his illegal action, economic embargoes, and the use of armed force.

While the application of these new principles was not always successful in preventing war or in thwarting aggression, the opinion continued that the international duel is incompatible with modern civilization, and that it may be both immoral and impolitic to treat the aggressor and his victim alike.

Aggressively inclined states have reacted to the same opinion by manifesting a disinclination to acknowledge that they are engaged in war. They have sought to represent their military activities as policing expeditions like the interventions and pacifications of the earlier period. In the hostilities from 1920 to 1956 there were no declarations of war except in the Chaco affair (1932-1935), in the wars against Germany and Japan in 1939, and in the pronouncement by certain Arab states in 1949 that they were in a state of war with Israel. The United States proclaimed neutrality only in the Ethiopian hostilities of 1935, and on the outbreak of World War II. The hostilities in Spain (1936), in China (1937), in Finland (1939), in Korea (1950), and in Egypt and Hungary (1956), though the first two each involved more loss of life than did the American Civil War, were not recognized as war in the legal sense.

Nonbelligerents, even if they have not applied sanctions, have considered themselves free to do so. The League recommended discriminatory action, not only in the Ethiopian hostilities but also in the Chaco, Far Eastern, and Finnish hostilities. The United States government, through the Export-Import Bank, made loans to China and to Finland, gave destroyers to Britain, and aided the Allies by lend-lease, all of which would have been incompatible with the international law of neutrality. The United Nations organized a police force to stop hostilities in Korea (1950) and Egypt (1956) and recommended cease-fires or armistices which stopped hostilities in Indonesia (1947), Kashmir (1949), and Palestine (1949). Similar methods to end hostilities in Greece (1947) and Viet Nam (1954) were undertaken by international action largely outside the United Nations.

Thus war, instead of being a status, which arises from the decision of the state which declares it or which begins hostilities with warlike intent and thrusts the status of belligerency or neutrality upon other states whether they wish it or not, has become a status which exists only insofar as the states of the world recognize it. If they choose to recognize the hostilities, not as war but as aggression, and to discriminate in favor of the victim, they are free to do so under the Covenant, the Pact, and other antiwar treaties. They are obliged to do so under the United Nations Charter if aggression is properly determined.

The consequence, therefore, of the intensification both of war *de facto* and of efforts to prevent such war, has been a tendency for war *de jure* to disappear. The Summit Conference

among the political chiefs of France, United Kingdom, the Soviet Union, and the United States in 1955 resulted in the common recognition that war with hydrogen weapons would be suicidal and that no state would voluntarily initiate it. The fear that such war might emerge through misunderstanding or the aggravation of a "small war" was, however, by no means eliminated. The distinction between states of war and of peace, between war and hostilities short of war, between belligerency and neutrality, have all become less precise, as have the rules defining belligerent and neutral rights.

Changes in the Law of Peace.—The decade of juristic optimism and of organized internationalism following World War I was characterized by a distinct lack of interest among jurists in the laws of war and neutrality and an extraordinary increase of juristic interest in the development of the international law of peace, especially the law defining procedures of international adjudication, legislation, and administration, and the law regulating international cooperation in matters of communication and transit, administration of mandated territories, protection of minorities, trade in opium and narcotic drugs, slavery and the slave trade, conservation of the resources of the sea, and others. The Permanent Court of International Justice, the International Labor Organization, and the League of Nations operated efficiently and, until the outbreak of World War II with increasing prestige in the nonpolitical fields.

Throughout this period, however, it was realized that these achievements were endangered by the continued insistence of states upon the free exercise of their military, political, and economic sovereignty. Efforts were accordingly made by international conferences to bring about military and economic disarmament and to require the submission of all international disputes to some form of pacific settlement. These efforts, while achieving some successes in the Washington Disarmament Treaties of 1922 and the considerable ratification of the optional clause of the Permanent Court of International Justice and the General Act of Pacific Settlement, were not adequate. Movements for economic self-sufficiency following the failure of the economic conference of 1927 contributed to the great depression of 1929, and to the rise of international tensions. Hostilities were renewed in 1931 with the Japanese invasion of Manchuria, and they rapidly spread, through Italian, German, Soviet, and further Japanese aggressions, to Ethiopia, Spain, China, Albania, Czechoslovakia, Poland, France, Britain, the Dominions, the Baltic States, Finland, the United States and most of the states of the world, carrying in their wake a reduction of international confidence, a weakening of the League of Nations and the Pact of Paris, a diverting of the energy of all states to military preparedness or to war itself.

The deteriorating situation led to new efforts to regulate war, taking form in new Geneva Conventions of 1929 and 1949 and in the London Conferences of 1930 and 1936, aimed at protecting civilians and the sick and wounded in war, and also to a new effort to prevent war through the United Nations, established by the San Francisco Conference near the end of World War II.

Many have become convinced that modern conditions of interdependence and rapid tech-

nological change require international legislative procedures to adapt state power to the needs of the community of nations, parallel with executive procedures to prevent violations of the law. The difficulties of these problems, however, cannot be minimized. Normal reliance upon coercing states as such was rejected by the makers of the United States Constitution and did not work under the League of Nations Covenant. Although a more organized plan for coercing states was contemplated by the United Nations Charter, it could not often be applied in practice because of the great power veto. Powerful states resent coercion and their nationally minded populations cleave closer to the aggressor government when external sanctions are imposed against it. Furthermore, the states applying sanctions suffer inconveniences and dangers and are apt to be hampered by a public opinion opposed to visiting hardships upon that section of the aggressor state's population innocent of wrongdoing.

No less difficult has been the problem of peaceful change. Even federations have not often transferred territory from one member state to another. Article XIX of the League of Nations Covenant which envisaged changes of territory and of inapplicable treaties, as an offset to the guarantee of the territorial status quo by Article X, was not successfully applied. President Woodrow Wilson's draft article from which these two clauses of the Covenant developed contemplated a closer relationship between them. In his thought, the territorial guarantee was to be subject to an international right of eminent domain, exercised by the League of Nations, and involving compensation to the state deprived of rights. He suggested: "The contracting powers unite in guaranteeing to each other political independence and territorial integrity; but it is understood between them that such territorial readjustments, if any, as may in the future become necessary by reasons of changes in present racial conditions and aspirations or present social and political relationships, pursuant to the principle of self-determination and also such territorial readjustments, as may in the judgment of three fourths of the delegates (at the assembly) be demanded by the welfare and manifest interest of the peoples concerned, may be effected, if agreeable to those peoples; and that territorial changes may in equity involve material compensation. The contracting powers accept without reservation the principle that the peace of the world is superior in importance to every question of political, jurisdictional boundaries."

Such a procedure might be useful, but it seems probable that a legislative authority which will gradually reduce the military and economic importance of boundaries may prove more practicable than such an authority to change the boundaries themselves. With freedom of interstate commerce and with the prohibition of interstate war, it has not been necessary to change boundaries of the states in the United States. Experience under the Articles of Confederation, as in the modern family of nations, suggests that forces of interdependence cannot function if sovereignty can erect tariff walls and prepare for military aggression without limitation. International law must assure freedom of trade and communication and security from military invasion across all frontiers as well as a moderate protection of the civil rights of individuals, especially the

freedom of opinion and the press. Only with the latter can the world be protected from the intense nationalism which may be produced by the propaganda devices now available when counter-propagandas are barred.

Human Rights.—The new institutions established after World War I and strengthened after World War II sought to effect changes to meet these requirements, but they have not achieved either justice or order in the world. There is a growing opinion that the task cannot be fulfilled unless international law recognizes that the state is for man, not man for the state, and establishes, in larger measure, common standards for the protection of human rights. It seems clear, however, in view of the persistent sentiment of nationalism, that such progress depends upon increasing identification in both public opinion and government policies of the national interest of each state with the universal interest of mankind.

Certain steps in this direction were taken before World War II, as for instance the right of petition accorded to the minorities and to the inhabitants of mandated territories, and the increasing tendency of jurists to treat individuals as subjects of international law, a tendency which gained some support from the practice of arbitral tribunals in adjudicating claims of aliens against the state of residence. Though formally such claims have been presented by the state of which the injured individual is a national, in fact the individual has often been recognized by the tribunal as the real party at interest.

These tendencies have received greater impetus in the "Declaration by United Nations" on American entry into World War II, and the United Nations Charter of 1945. These declarations called for the freedom and welfare of the individual rather than the rights of states. Organizations in the fields of relief and rehabilitation; food and agriculture; aviation and telecommunication; trade and finance; science, education, and culture; and technical assistance and atomic energy were established under United Nations auspices to serve human needs directly, as did the International Labor Organization which continued from the earlier period. The United Nations Charter, while founded on the principles of "the sovereign equality of members" and the obligation of members to settle disputes peacefully, to refrain from the threat or use of force in their relations, and to assist the United Nations in preventing aggression (Article 2), was declared to be the work of "we the peoples of the United Nations." Furthermore, among its primary tasks is the promotion of "universal respect for, and observance of, human rights and fundamental freedom of all without distinction as to race, sex, language or religion."

A practical exemplification of the direct relationship of the individual to the world community was exhibited in the Charter for the Trial of Major War Criminals concluded among the United Nations in August 1945. This charter defined crimes against the peace, war crimes, and crimes against humanity for which there should be individual responsibility, irrespective of the official position or governmental authorization of the defendant. The International Military Tribunal, established at Nürnberg in accordance with this charter, tried 21 Nazi officials indicted for one or more of these offenses, and a similar tribunal in Tokyo tried the principal Japanese

officials responsible for the war in the Far East.

The development of nuclear energy led immediately to proposals for monopoly control by an international agency of the natural resources and manufacturing facilities for making atomic weapons (Baruch Plan) and, while this proposal has not been accepted, a United Nations Atomic Energy Agency was established among 82 states in 1956 to assure cooperation in expanding the peaceful uses of atomic power (Eisenhower Plan).

THE FUTURE

International law will doubtless continue to balance the principle of national sovereignty against the principle of world society; but the rapid strides of science and technology in eliminating distances, augmenting powers of destructive aggression, and reducing powers of defense have created a demand to shift the center of equilibrium in the direction of world society. This has led to the institutions and legal principles accepted in the United Nations Charter. The sentiment of nationality and the tradition of sovereignty remain, however, as active forces. The governments, particularly of great states, hesitate to relinquish their prerogatives. Consequently the problem of establishing an international law able to maintain the world in dynamic stability will not be easily solved.

The difficulty was accentuated after World War II by the cold war. Opposition between two halves of the world, headed respectively by the Soviet Union and the United States, led to an arms race, political instability, and the incapacity of the United Nations to function as planned. The Soviet Union opposed the evolution of the United Nations as a curb on national sovereignty, hampered the work of that organization by frequent use of the veto in the Security Council, reduced its neighbors to a satellite status in an aggressive bloc to expand its system, and curtailed trade and communication across the Iron Curtain which separated that bloc from the rest of the world. The Western powers, while seeking to build the United Nations and its specialized agencies into instruments for rehabilitating war-shattered economies, for promoting human warfare, and for developing a sense of world solidarity, resisted any encroachment upon their "domestic jurisdiction" to deal with colonial, racial, and federal problems, organized blocs to oppose the Soviet system, and often dealt with security problems independently. The United Nations has, therefore, accomplished less than anticipated in the field of international security. It has not been able to achieve either atomic or conventional disarmament, to establish a permanent international force or to settle disputes directly involved in the "cold war." It has declared a universal bill of human rights and opened a convention on genocide for ratification; has recognized that action to suppress colonial revolts or minorities in such a way as to threaten international peace and security is subject to discussion in the General Assembly; and has brought about important political changes such as the partition of Palestine, the recognition of Indonesia and Libya, and the establishment of trusteeships in Somaliland and the mandated territories except Southwest Africa. It has also established an International Law Commission instructed to develop and codify the law concerning the rights and duties of states, international crimes, and the regime of the high

seas. States, however, became convinced that so long as the United Nations lacks capacity to make decisions because of the veto and lacks material forces to implement them, they cannot rely on it for security. Consequently, they have utilized the freedom given them by Articles 51 and 52 of the Charter to create regional and collective self-defense arrangements in such a way as to increase the insecurity they hoped to reduce.

It seems to be clear that international law cannot, without important changes, maintain order in a world divided by rival ideologies, and in which both nationalism and internationalism have reached the intensity and organization which they have in the 20th century. Ideological crusading must be subordinated to the stabilization of a society of coexisting nations and sovereignty of the state must be limited by appropriate laws and institutions in the military, political, and economic fields, in order that all peoples may advance in freedom and welfare through international cooperation for the common interest. The alternative appears to be a further isolation of national cultures and economies and a general diminution of human freedom and standards of living. The anarchy which results from extreme claims of sovereignty and ideological intolerance, and the wars which result from this anarchy, are incompatible with the progress of civilization in a rapidly shrinking world.

The future is uncertain, but the important development of the science and practice of international law, and the increasing number of individuals, organizations, and journals devoted to the subject since the establishment of the League of Nations, the United Nations, and the World Court suggest that international law will not disappear. The grave problems of sanctions and of legislation, of collective security and of peaceful change have not been solved, but the need to solve them has become greater than ever.

It remains to be seen whether, from the power rivalries of states, of regional arrangements, and of general international organizations, a more stable condition of affairs will develop in the shrinking world within which a new international law, forbidding aggression, demanding pacific settlement, protecting human rights, and facilitating cooperation for human welfare, can be maintained by suitable institutions. The activities of the United Nations in the autumn of 1956 were immediately successful in stopping the hostilities of Israel, France, and Great Britain in Egypt, and in mobilizing world opinion against the Soviet invasion of Hungary. While peaceful settlement of the problems of Suez, Israel, and the Soviet satellites proved more difficult, principles of international law were, under the initiative of the secretary general of the United Nations, accepted as guides for such settlements. This experience suggests that the distribution of power in the world may undergo changes toward a more stable equilibrium and a more effective United Nations, permitting a larger influence to international law.

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INTERNATIONAL MONETARY FUND. See BANKS AND FINANCE—19, *International Monetary Fund*.

INTERNATIONAL PEACE GARDEN. a memorial garden and park which straddles the international boundary between the State of North Dakota and the Province of Manitoba, Canada, in the Turtle Mountains area, about 15 miles



N.D. State Soil Conservation Committee

Aerial view of International Peace Garden.

south of Boissevain, Manitoba, and 12 miles north of Dunseith, N.Dak. It commemorates the long history of peaceful relations between the United States and Canada. Proposed in 1929, the memorial was made possible by gifts of land totaling over 2,300 acres by Manitoba and North Dakota. At its dedication in 1932, a stone cairn was unveiled bearing an inscription pledging the two nations to peace "as long as men shall live." Tourist and camping facilities were added in the 1930's, and after World War II the state and province cooperated in developing a mile-long

series of terraces and formal gardens along the international border.

INTERNATIONAL RED CROSS. See *RED CROSS—Organization and Service.*

INTERNATIONAL RELATIONS.
Private International Activities.—International relations in the broadest sense embrace all intercourse between persons belonging to different nations. Merchants and navigators; bankers; industrialists; tourists; churches, artistic, scientific, professional and athletic associations; trade unions, and chambers of commerce all engage in activities that cross national boundaries. The earliest records of civilization show some of these activities, already in progress. They have their origin in the fact that civilized man has never been able to satisfy his needs and desires within the limits of the political groupings that we now call nations or states. Their importance to the strength and welfare of the nation, particularly when they have to do with commerce, was early understood, and some effort was made to protect them from the interruptions incidental to the frequent quarrels of princes. Such, for example, was the purpose of the provision in the Magna Carta offering merchants from countries at war with England safety of person and goods on condition that English merchants were given the same treatment in the enemy country. The earliest compilations of international usage (which were quite unofficial) set out the rights and duties of navigators and merchants. Consular services for the protection of these adventurers in foreign parts, at first arranged by their own associations, were taken over by some states even before permanent embassies for the conduct of official relations came into use in the 15th century.

Public International Activities.—In countries where private enterprise is still favored, the vast international exchange conducted by individuals or nongovernmental organizations is distinguished from official or public international relations, in which the persons engaged act not in their private capacity but as representatives of their respective states. A large part of these public relations is concerned with the protection and advancement of the foreign interest of specific citizens and corporations, for the nation's ability to defend and maintain itself depends in large measure on the prosperous activity of its members. There is therefore no less general national interest in facilitating such activity than in keeping up the armaments and alliances which are the immediate instruments of national security. Under totalitarian socialist regimes, where the government takes direct control of all international relations, the distinction between public and private tends to disappear, as it also does in internal affairs.

Diplomacy and Human Relations.—Official foreign relations, apart from those of war, were once almost exclusively the business of princes themselves or their foreign offices. This was diplomacy, mysteriously carried on through the imposing embassies and legations maintained in foreign capitals and very remote in appearance from the ordinary concerns of the average man. It was through this machinery that governments kept themselves informed of favorable or threatening developments abroad, kept up the necessary

network of treaties on commerce, boundaries, mutual defense, arbitration, extradition and a mass of other international business, and smoothed out, or failed to smooth out, the conflicts of interest that constantly arose in the international competition for territory, resources, and friends.

Personification of the State.—The increasing scope and tempo of international intercourse and the general expansion of state business gave many other departments of government a hand in the formulation and conduct of foreign policy, while a growing realization of its intimate bearing on the everyday life of the individual gave rise to a demand for citizen participation in its direction. This expansion of scope, interest, and participation, together with the fact that the nation's power, prestige and security, and the issue of peace or war are so directly involved, accounts for the unique hold of these official relations upon public attention. International relations come to be thought of almost solely as the relations of France, Britain, the United States, Russia, and the 90 other "sovereign states" of the world. These abstractions are pictured as distinct beings in their own right, feeling, wishing, and acting in their own peculiar ways. We personify the state, and this mental trick obscures the fact that all international relations are human relations, complicated though they may be by the division of humanity into national compartments, and that the actors on the international stage are always human beings.

Uniformity and Change in Foreign Policy.—One consequence of this personification is a tendency to attribute an excessive fixity to the attitudes of governments in international affairs. It is true that geographical situation, material resources, cultural tradition, and historical growth make a sort of framework that limits the variations of response to external challenge and fosters a vein of continuity in foreign policy. To that extent there are French, British, American, and other national foreign policies that remain uniform in their broad lines over considerable periods. But the framework itself is subject to change by human action, and its significance may be radically altered by technological developments. Thus a succession of governments content to make the best of existing conditions may be followed by one determined to alter them by conquest or colonization; or again the invention of new modes of transportation or new weapons may change a policy of isolation to one of active participation in world politics. Growth of population may set up a demand for increased resources, and the response of government may be a new economic policy or a plan of territorial expansion. Ideas of what the nation needs, in other words notions of national interest, though to some extent hereditary, vary in response to a multitude of changing factors, and the objects and methods of governments vary with them. Prominent among these variables are the differences of individual character. Not even the most constant physical factors of environment operate automatically and directly upon policy; all exert their influence only through the refracting medium of human minds.

Students of international relations, or world politics, are always seeking constants among the shifting notions of national interest and the changing objects of policy. Some think they have found the universal determinant in the competition

for power. It is, they say, a uniform goal of the participants in world politics to maintain and if possible expand national power. Part of their proof lies in the historical and continuing value attached to what is described with some inexactitude as the balance of power.

Balance of Power.—It is true that governments have traditionally resisted and still resist the accumulation by a potential enemy of such a superiority or overbalance of power, either by armaments or by alliances, as would make national defeat likely in the event of war. It is also true that they try to prevent or to outmatch hostile accumulations of voting power in international organizations. What they really seek is not so much a general equilibrium as an overbalance of power on their side. The occasions on which governments have voluntarily surrendered power in order to achieve an equilibrium have been rare and dubious, while history is full of their unmistakable attempts to achieve a predominance. But, though balance in the sense of equilibrium is a misleading term in this context, the struggle to avoid losses and make gains of power accounts for much of the maneuvering associated with diplomacy. It is the essence of the "cold war," which is of course an ancient type of tension given new dimensions and a new name. In such struggles neither side seeks a mere equality or equilibrium: the aim of both is to gain and hold a lead in every element of power. With two gigantic concentrations of power, and only scattered and relatively weak groups of neutral nations uncommitted to either, the international scene is dominated by the explosive rivalries of the major blocs and their efforts to win the neutral groups or at least to prevent them from joining the opposing camp.

Power, Welfare, and Foreign Policy.—The power struggle is, then, a prominent feature of international relations. Nor is it eliminated by international organization where, however, in the measure of the organization's success, it does take on an importantly different, nonviolent form. But it is only by an excessive stretching of words that it can serve as the essential explanation of the general foreign policy of certain states or the occasional policy of others. Swiss governments, for example, can hardly be said to calculate national interest in terms of power. Even in the lives of stronger nations governments have sometimes been persuaded that changes in policy involving a voluntary shrinkage of international stature were imperative. Interests other than power, that is to say, have been given priority. Political leaders making the national power position their prime concern could hardly have countenanced the turn in 19th century Sweden from a large and adventurous military program to external peace and internal political-social reform and economic development or, later, have cooperated in the dissolution of the union with Norway. Nor does the power motive go far to account for the evolution of the British Empire into a Commonwealth of Nations whose members are free to secede at will. Finally, though there has been no little hypocrisy in official statements of devotion to the League of Nations or United Nations, the struggle for national power is an inadequate explanation of the residue of serious effort that has gone into international political organization. Addicts of the power thesis oversimplify and distort the

complex of factors and motives that influence responsible statesmen.

National Interests and International Relations.—Theoretically, governments in their foreign relations serve primarily the collective interests of the nation, championing the private activities of their fellow countrymen abroad only insofar as these redound to the general national advantage. Foreign policy, to the extent that it is a product of deliberate choice, may be defined as the plan by which governments seek to realize national aims in the international sphere. But because the plan is devised and executed by human beings, the calculation that precedes the choice of ends and means is only more or less detached from motives of private advantage. As objectives of policy the collective interests of the nation are at best only what the policy makers of the moment think they are, and statesmen are not proof against our human habit of assuming that what is good for us and our friends is also good for the nation. Powerful individuals and groups are therefore able from time to time to sway foreign policy in the direction of particular interests only nominally identified with the general good. The "devil" theories of world politics that find the real direction of international relations in the munition makers or captains of finance, melodramatically exaggerated as they have been, have some basis in reality. But, for the same reasons, foreign policy may be swayed by powerful individuals or groups seeking such broad human ends as universal peace and the worldwide advancement of living standards, and seeing the highest national interest in serving these ends.

Reason of State.—The state, being personified, was also deified. "Reason of State" became a commandment. This doctrine has served to excuse and even to glorify things done in the name of the state which on any other account would be condemned as immoral or even inhuman. It continues to be a dominating influence in international relations. Based upon the principle that self-preservation is the first duty of the nation and that the nation's constituted authorities alone decide when its existence is at stake and what means are appropriate to its salvation, the doctrine, though verbally repudiated by the statesmen of most countries, was implicit in the generally accepted view that nations had a right to go to war at their own discretion. It survives in the common opinion that the state has its own necessities that take priority over considerations of law or morality.

War.—Private war became illegal and obsolete as the local potentates of feudalism were compelled to submit to the central authority of the modern state. When that change was complete, the only war permitted was that authorized by a sovereign government. The state, in pursuit of its international aims, was thought entitled to the recourse to general violence that had now been forbidden to its subjects. Churchmen and lawyers tried to establish the principle that war without just cause was illegal, and much of what is now known as international law grew out of their endeavor; but princes insisted upon their own ideas of justice.

Contemporary international political organization is built upon treaties that purport to "outlaw," or to place far-reaching legal restrictions upon, war by states. The object is to substitute peaceful settlement of disputes for the age-old

free recourse to arms, and to guarantee national security by collective police action against aggressors. This effort is one of the distinguishing features of international relations in our time. The slowness with which it proceeds is due to the fact that its success presupposes a drastic change in habits of thought and feeling ingrained in men for centuries.

The groupings of human beings out of which the modern state grew were instruments in the competitive struggle for existence. Men found in them some protection against the marauding outsider and a means of success in their own marauding. The more or less constant state of war bred an enduring distrust and fear of foreign groups and a corresponding devotion to one's own. The state came to be regarded as something much more than a mechanism for human service. It assumed the character of end in itself—an organism whose needs were the supreme law. That is why great differences of moral and legal quality still distinguish the relations of state to state from those of man to man, and why it proves so difficult to subordinate the state to any higher authority.

A Law of Nations.—Yet from the earliest recorded times there has always been some effort to regulate the relations of state to state. Forms resembling those used in the legal relations of individuals within the state very early made their appearance in the arrangements that had to be made from time to time between rulers. We have records of treaties going back as far as the fourth millennium B.C. These were in the nature of contracts by which kings promised each other peace, settled boundaries, made alliances. Like many private contracts, they were accompanied by an exchange of oaths or of more material security to guarantee performance. Slowly, too, some unwritten understandings won general approval. Envoys sent by princes to do business with foreign rulers should have safe conduct on their missions. Wars should not be launched without a previous statement of grievances which the offending state might choose to remedy rather than take the risks of battle.

These rudiments of a law of nations, developing through Greek and Roman times, persisted through the Middle Ages. They were fostered by the church, the ecclesiastical influence on the whole favoring fidelity to promises and moderation in the use of force. Some corresponding development had long been in progress in the Near, Middle, and Far East; though such restraints, frail and sporadic enough between peoples of the same civilization, were even weaker in the relatively rare contacts between different civilizations.

With the Renaissance came a strong upsurge of ideas about a universal human law governing princes and peoples in their dealings with one another. Besides treatises on the law of nations coming off the new printing presses, ambitious plans of European or universal organization to prevent war and compel the peaceful settlement of disputes were circulated by jurists, poets, philosophers, and even kings. These blueprints were read, admired, and left on library shelves. But the body of treaty rules and customary forms continued to grow and, despite the absence of those agencies of enforcement that are found indispensable to national legal orders, it provided a routine in which much of the ordinary business of states could be transacted with peaceful effi-

ciency. It would be a long time yet before war ceased to be looked upon as a normal way of getting what any strong nation wanted badly; but the growing official habit of thinking about the relations of states in legal terms, coupled with the evolution of rational patterns of practice, eliminated some of the frictions out of which armed conflict is apt to spring.

The Conference System and the Concert of Europe.—Gradually taking practical shape in Europe was the notion of a certain collective authority and responsibility resting upon the greater powers to establish and from time to time repair or adjust a general framework of order sufficient at least to prevent the dissolution of the common culture in chaotic violence. The Congress of Westphalia, which in 1648 ended seven years of difficult negotiation with a general settlement of the religious, territorial, and political conflicts of the Thirty Years' War, was the first of a series of conferences that drew and redrew the political map of Europe. It was in the Treaties of Utrecht, 1712–1713, that the principle of distribution was described (Latin still serving as the written language of diplomacy) as *justum potentiae equilibrium*—a fair or just balance of power.

Characteristic of these distributions from Westphalia in 1648 to Vienna in 1815, and even later, was the fact that their fairness was decided exclusively by the great powers. Smaller states were carved up or auctioned off as make-weights in the bargaining of the great. But, even among the great, at least one speedily found the balance cramping on ambition and set about destroying it. After the ensuing struggle, another conference must adjust the distribution to a new constellation of forces. This highly opportunistic process of balancing and rebalancing came to be euphemistically known as “the public law of Europe.”

At the Congress of Vienna, where in 1815 the wreckage of the Napoleonic War was temporarily patched up, a new tendency made its appearance. The conferences began to make incidental additions of a humane or utilitarian character to this “public law.” The slave trade was to be checked by international cooperation. Navigation on rivers traversing more than one nation was to be open to the ships of all flags. At Aix-la-Chapelle in 1818 an agreed classification and precedence for the heads of diplomatic missions was established. The Concert of Europe though much more of an idea than an organization, expressed something of that sense of community which is the beginning of all law. At Paris in 1856 privateering was abolished, rules laid down regarding contraband and blockade, and a resolution adopted in favor of general arbitration. At the same time the Concert first extended formal recognition to a non-Christian country, Turkey.

From that time on the conference system rapidly expanded in subject matter and became worldwide in participation. Soon it was setting up the Universal Telegraph and Postal unions, the first in the long line of international service agencies. At Geneva in 1864 a convention was concluded for the care of the wounded. Four years later 17 governments joined in the Declaration of St. Petersburg prohibiting explosive bullets. The Hague Peace Conferences of 1899 and 1907, originally intended as meetings of the powers to plan disarmament and arbitration, did

contrive an elaborate though entirely optional procedure for arbitration, but were, paradoxically, best known for their detailed "Regulations" for warfare by land and sea and their code of rules on the treatment of prisoners.

The plan for a third Peace Conference was abandoned in the accelerating movement toward World War I. That immense calamity lent a short-lived urgency to plans for the organization of peace, which were now taken up by the governments. The League of Nations, with its bevy of ancillary agencies, was the result.

International Agencies and the State.—The proliferation since the middle of the 19th century of international agencies serving interests recognized as common to many peoples is an acknowledgment that the state is less and less adequate as a device for meeting the needs of modern life. If the trend continues, it must reduce the importance attached to the state and its power. As the individual's dependence upon the state for services is transferred to other organizations, these must win some share of his allegiance. The creation of such unions as the European Coal and Steel Community is a move away from state sovereignty. Though we are still far from general world government, each new international agency may prove a step in that direction. Knowledge that this is so explains much of the nationalistic opposition to international organization.

A prominent characteristic of modern international relations is the conflict between the desire of governments to maintain the state in its position as the supreme object of human loyalty, on the one side, and, on the other, the necessity of securing services that can only be rendered by international agencies taking over some of the powers of states. The security of the national domain and the national way of life is commonly regarded as the prime function of the state. But the establishment of the League of Nations in 1919 was an official admission that the accumulation of national armaments is not a solution and that lasting security calls for permanent organization broader than the state. The League failed to win security for its members because neither governments nor their peoples were ready to transfer to it the formal authority and material power necessary.

The central debate in the United Nations is a phase of the same conflict, sharpened by the advent of weapons of mass destruction, between the traditional image of the state and the requirements of a collective security system. This debate is not one that divides East from West or the totalitarian from the democratic nations. It is common to humanity. As modern weapons make war, with its threat of total destruction, a less and less usable instrument of national policy, the search for other means of settling conflicts of interest takes on a desperate urgency. Hitherto, the search for public order has found its goal only in central authority exercising a monopoly of force. The international movement in that direction has brought great changes in the relations of states. As was shown in the Suez conflict of 1956, some restraining influence had been achieved even over the conduct of major powers. The scramble for colonies had been checked, the treatment of dependent peoples brought under supervision. It was no longer easy to manipulate small nations. Their independence had found a measure of protection in the United

Nations. But the limits of that protection were tragically demonstrated in Hungary while the Suez crisis was urgent. In that case one of the two greatest powers found it easy to defy all the restraints that contemporary world organization could bring to bear. International relations had not yet been transformed from the intermittently violent intercourse of states priding themselves on their sovereignty to the legally ordered relations of subgroups in a strongly organized universal society.

See also CONCERT OF EUROPE; HAGUE COURT; INTERNATIONAL LAW; INTERNATIONAL TELECOMMUNICATIONS UNION; LEAGUE OF NATIONS; INTERNATIONAL CONFERENCES—*Organizing the United Nations System*; UNITED NATIONS, THE; UNIVERSAL POSTAL UNION.

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INTERNATIONAL SOCIETY OF CHRISTIAN ENDEAVOR, an international, interracial, and interdenominational movement, with societies for all age groups in Protestant evangelical churches. The society includes groups in the United States, Canada, and Mexico.

The first Christian Endeavor Society was organized Feb. 2, 1881, in the Williston Congregational Church, Portland, Me., by Dr. Francis Edward Clark (q.v.). Since then the movement spread until in 1957 the World's Christian Endeavor Union included approximately 3,000,000 members in 80 denominations in over 50 countries or island groups.

Christian Endeavor has a fourfold purpose: (1) to lead young people to commit themselves to Jesus Christ as Lord; (2) to bring them into the life of the church; (3) to sustain and train them for active Christian service; and (4) to release them through all channels of human activity in the service of God and man. The Christian Endeavor pledge is the basis for membership.

Societies are organized into local, county, district, state or provincial, and national unions. The headquarters for the International Society and the World's Union is in Columbus, Ohio. The official publication is *The Christian Endeavor World*, issued monthly, and the society's motto is "For Christ and the Church."

INTERNATIONAL TELECOMMUNICATION UNION (ITU), an international body whose chief purpose is "to maintain and extend international cooperation for the improvement and rational use of telecommunication." Formed in 1932, at Madrid, it replaced the International Telegraph Union, established at Paris, 1865. Its structure consists of a plenipotentiary

conference, administrative conferences, and several permanent organs: an administrative council, a general secretariat, the International Frequency Registration Board (IFRB), the International Telegraph and Telephone Consultative Committee (CCITT) and the International Radio Consultative Committee (CCIR). The seat of the union in 1954 was Geneva, Switzerland.

INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION (IT&T), an American corporation primarily engaged in the development and manufacture of electronic equipment either directly or through subsidiaries in the United States and abroad. Its 37 laboratory and manufacturing units comprise 80 principal plants in 20 countries: the United States, Argentina, Austria, Australia, Belgium, Brazil, Canada, Chile, Denmark, England, France, German Federal Republic, Italy, Norway, the Netherlands, Puerto Rico, Portugal, Spain, Sweden, and Switzerland. The corporation also has 12 telephone, radiotelephone, and radiotelegraph operating companies in seven countries: Argentina, Bolivia, Brazil, Chile, Cuba, Peru, and Puerto Rico; two marine radio companies in two countries: England and Spain; and a controlling interest in the American Cable & Radio Corporation, whose subsidiaries are All America Cables and Radio, Incorporated; The Commercial Cable Company; Mackay Radio and Telegraph Company; and Sociedad Anónima Radio Argentina. Altogether, IT&T employs about 125,000 persons.

Principal products of the IT&T system include wire and radio communication equipment of all types, radar and radio aids to navigation, electronic systems and equipment, and components. Its sales organization has outlets throughout the free world, where it is an important supplier to both governments and private industries. Important contributions of its research programs include microwave radio, automatic direction finders, selenium rectifiers, ILS (instrument low-approach system), TACAN (tactical air navigation), and a variety of systems and devices in the growing field of automation.

INTERNATIONAL TRADE ORGANIZATION. See **FREE TRADE.**

INTERNATIONAL TYPOGRAPHICAL UNION (ITU), a labor union of skilled printing trades craftsmen, the first of the craft unions in the American labor movement to be organized on a national scale. On May 5, 1852, journeymen printers from typographical unions in 14 cities, meeting in convention in Cincinnati, Ohio, organized the National Typographical Union, by which title it operated until 1869, when a new constitution was adopted, accepting affiliation of the Canadian printing trades unions and changing the name of the organization to the International Typographical Union.

The ITU has a membership of more than 100,000 men and women—all journeymen and apprentices employed in composing rooms and mailing rooms of newspapers, trade plants, book and job publishing houses, and commercial printing establishments. There are more than 800 subordinate typographical and mailer unions of the International Typographical Union located in cities on the North American continent and

Hawaii. The membership comprises printers, mailers, proofreaders, linotype operators, machinists, photocomposition experts, rulers, paste make-up artists, job or ad setters, stone hands, lineup men, typesetter operators, press operators, and dozens of other skilled craftsmen doing jobs indigenous to the printing and publishing industry.

As a pioneer among the labor unions of the nation, the ITU played a major role in bringing about the formation of the American Federation of Labor. Delegates representing other organized trades were called together by the ITU for a meeting in Pittsburgh on Nov. 15, 1881, which resulted in an organization known as the Federation of Organized Trades and Labor Unions of the United States and Canada. Following minor changes and realignments, this congress later became the American Federation of Labor. In 1935, Charles P. Howard, then president of the ITU, was one of the 10 men who formed the Committee for Industrial Organization (CIO).

Within the printing industry itself, the ITU also brought into being four other unions of allied craft workers. Before local unions of printing pressmen, bookbinders, stereotypers and electrotypers, and photoengravers established their own autonomous international unions, they were organized and chartered by the ITU. In 1896 local unions of both printing pressmen and bookbinders were released from the jurisdiction of the ITU and formed their own international unions. The stereotyper and electrotypewriter members took similar action in 1901, and were followed by the photoengravers in 1904. Since 1911, the five international printing trades unions have maintained an alliance through the International Allied Printing Trades Association, formed in that year for the purpose of joint ownership and control of the allied printing trades Union Label.

The ITU has been in the forefront of the labor movement in gaining for its members fair wages, a shorter workday, fair working conditions, protection of the rights of the individual under union laws, and contracts with employers. The first of the international unions with a pension system (begun in 1908) and a mortuary benefit plan (since 1891), the ITU has also maintained the Union Printers Home in Colorado Springs, Colo., for the care of its aged and incapacitated members since 1892.

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INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS (UGGI), an organization formed in 1919 as a constituent union of the International Research Council (now the International Council of Scientific Unions). It comprises the international associations of Geodesy, Seismology and Physics of the Earth's Interior, Geomagnetism and Aeronomy, Physical Oceanography, Vulcanology, and Scientific Hydrology. The objectives of the UGGI are threefold: (1) to foster studies relating to the size and shape of the earth; (2) to initiate, facilitate, and coordinate geodetic and geophysical research requiring international cooperation; and (3) to provide for discussion, comparison, and publication of results.

Membership in the UGGI is open to any nation sharing the maintenance expenses of the union.

Within a country, the group having formal ties with the UGGI usually is either the government itself or the national academy of sciences. In 1957, the UGGI had 46 members: Argentina, Australia, Austria, Belgium, Canada, Chile, Colombia, Czechoslovakia, Denmark, Egypt, Finland, France, German Federal Republic, Great Britain, Greece, Haiti, Hungary, India, Indochina, Indonesia, Ireland, Israel, Italy, Japan, Mexico, Morocco, Netherlands, New Zealand, Norway, Pakistan, Peru, Philippine Islands, Poland, Portugal, Spain, Sudan, Sweden, Switzerland, Syria, Thailand, Tunisia, Turkey, Union of South Africa, United States, Union of Soviet Socialist Republics, and Yugoslavia.

The main administrative and policy-making body of UGGI (especially in matters involving finance) is the Council, on which each member country has one representative. The Executive Committee is a smaller body whose primary function is to make decisions on urgent technical and administrative matters requiring action between General Assemblies. The final authority in all matters of the union (scientific, administrative, and financial) is the body of delegates from member countries meeting each three years in a General Assembly. General Assemblies have been held in Rome (1922), Madrid (1924), Prague (1927), Stockholm (1930), Lisbon (1933), Edinburgh (1936), Washington (1939), Oslo (1948), Brussels (1951), Rome (1954), and Toronto (1957).

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INTERNATIONAL WORKINGMEN'S ASSOCIATION. See *INTERNATIONAL—First International*; *SOCIALISM—Socialist Internationals* (*First International*).

INTERNATIONALISM. See *NATIONALISM AND INTERNATIONALISM*.

INTERNMENT. See *ENEMY ALIEN PROBLEMS—Internment*.

INTERPELLATION, ĭn-têr-pê-lă'shŭn, in law, the act of demanding an official explanation of a member of the government, as in France and some other European countries. It is used more frequently in Italy and France than elsewhere. After due notice, any member of the particular legislative body may interpellate the ministry, and this often results in a general debate. Frequently a ministry resigns as a result of an interpellation. The right of permitting or refusing an interpellation rests with the legislative body, not with the ministry. An interpellation is followed usually by a vote of confidence or of want of confidence in the government.

INTERPRETATION, ĭn-têr-prê-tă'shŭn, in law, the art of determining the meaning of a speaker, or a writer, or of the parties to a written instrument, as a contract, deed, or the like. Courts of equity, in their interpretation and construction of instruments, follow the same rules as courts of law. The terms interpretation and construction, while frequently used interchangeably by some writers, should be differentiated according to others. In interpretation, they contend, the court decides simply the meaning of words and sentences, whereas in construction the court decides what is their legal effect. Interpretation is merely logical reasoning, while con-

struction is legal reasoning, these writers insist. The two terms, nevertheless, in practice at least, are generally used with identical meaning. The rules for interpretation vary to some extent with the particular class of instrument in dispute. For instance, wills are liberally construed, as the testator is not presumed to know the legal significance of all the terms he employs, but is held to use such in their popular meaning. On the other hand, a deed is generally construed strictly and against the maker when there is ambiguity. A contract must not be strictly nor liberally construed, but the intention must be drawn in the light of surrounding circumstances, as customs of the place or time, social conditions, and the like. Statutes abrogating the common law, as well as penal statutes, must be strictly construed. The same rule is applied to statutes affecting private rights. On the other hand, statutes designed to prevent fraud are liberally construed, and statutes must generally not be construed so as to operate retrospectively.

Some general rules of interpretation are as follows:

(1) The meaning of a word, clause, or other part of an instrument must be construed in the light of the whole instrument. Such disputed part may have its ordinary meaning entirely changed by this rule. (2) The meaning of the maker of an instrument is to be taken from what is therein contained and also from what may be fairly implied by custom or the like. (3) Due weight must be given to the construction placed upon the instrument by the parties themselves. (4) Words are to be taken in their ordinary meaning unless the writing or the attending circumstances indicate a contrary intention. (5) Where two interpretations are possible, that is to be preferred which is fair and reasonable. (6) Usually ambiguous language is to be construed against the maker of a private writing, as a contract or a deed.

In addition to the foregoing list, which is not complete, a large number of special rules have been framed to fit particular cases.

INTERPRETATION OF DREAMS (in German *Die Traumdeutung*), a book by Sigmund Freud (1900; translated by A. A. Brill, 1913) which has become a fundamental part of modern psychiatric therapy. It interprets the mind as an interfunctional unit of the Ego (the conscious, rational faculty), the Super-Ego (the Censor, or moral faculty), and the Id (the unconscious, irrational faculty). In presenting dozens of actual dream analyses, Freud demonstrates that dreams are neither meaningless nor prophetic, but are intelligible psychic productions. All dreams are symbolic fulfillments of wishes and desires suppressed by the Super-Ego. Freud notes three fundamental dream mechanisms: (1) Condensation, the fusing of various elements in the Id for economical transference to the Ego; (2) Displacement, the transferring of psychic importance and stress from the true objects in the Id to apparently trivial objects in the manifest dream; and (3) Dramatization, the embodiment of abstract ideas or emotions in visual terms. All of these processes also serve to disguise the expression of the suppressed wish from the Super-Ego. Since there is no standard, universal symbolism in dreams, the dream-analysis depends upon the dreamer's free-association of the manifest dream-content in terms of his own life experience. The forgetting of dreams is the belated activity of the aroused Super-Ego.

INTERSTATE COMMERCE. See *COMMERCE, INTERSTATE*.

INTERSTATE COMMERCE LEGISLATION. See *COMMERCE*—4.

INTERSTITIAL COMPOUNDS. See *INTERMETALLIC COMPOUNDS*.

INTERVAL, in music, is the distance or difference of pitch, arithmetically expressed, between any two tones of a given scale. Occidental nations, including those of the Americas, employ the diatonic scale (see *SCALE*), an octave comprising five tones and seven semitones, named after the first seven letters of the alphabet. The affix of a flat or sharp before a note denotes its quality but does not affect its name, and the eighth note, being in unison, commences a new octave. Taking the scale in the key of C major the various intervals are: minor second = E-F or B-C; grave major second = C-D, F-G, A-B; grave minor third = D-F; minor third = E-G, A-C, B-D; major third = C-E, F-A or G-B; perfect fourth = C-F, D-G, E-A, G-C', or B-E'; acute fourth = A-D'; acute augmented fourth = B-F; grave diminished fifth = B-F'; grave fifth = D-A; perfect fifth = C-G, E-B, F-C', G-D', A-E; minor sixth = E-C', A-F', B-G'; major sixth = C-A, D-B, G-E'; acute major sixth = F-D'; grave minor seventh = D-C', G-F', B-A'; minor seventh = E-D', A-G; seventh = C-B, F-C'; octave = C-C', D-D', and so on. By taking various notes of the diatonic scale as starting points and measuring known intervals from these, we arrive at intermediate notes of the scale, of which the following are examples: C# minor third below E; D# minor second below E; Eb minor third above C; Ab minor sixth above C; Bb minor seventh above C; B# 3 major third above C. The difference of pitch between C and C# or between D and D# is called a semitone, and an interval increased or diminished by a semitone is said to be augmented or diminished. This applies especially to the interval of a fourth or a fifth, which with the octave are said to be perfect, because any augmentation or diminution mars their consonance. The major sixth or third may, however, be diminished to a "minor" sixth or third without destroying the consonance; and the term "minor" is also applied to the diminished second or seventh. Intervals confined within the octave are simple, when they exceed it compound; the octave beginning a new series, the ninth is the octave of the second, and so forth.

INTERVENTION refers in international law to the dictatorial interference by a state in the internal affairs of another state or in the relations between two other states. It is formally forbidden by a number of treaties, especially among American states, and has been described as illegal in essence and to be justified only by its success.

Intervention is distinguished from mediation, or the offering of advice by a state after a request by other states, and from representations or protests which concern the demanding state's own interests or rights. It is also sometimes distinguished from interposition, or forcible action by one state in the territory of another to protect its nationals, and from defensive action to prevent an immediately threatened aggression. It may take the form of either military or diplomatic action; but diplo-

matic intervention implies resort to force if the demands are not complied with.

The motive of intervention is political, rather than legal. The United States has, in pursuance of policies related to the Monroe Doctrine (q.v.), intervened in Caribbean republics—in Cuba to establish the independence of that state, and in others to maintain order and international obligations. It has been party to treaties which permitted intervention in Cuba, Santo Domingo, Haiti, and Panama, although these treaties were subsequently terminated in connection with the "good neighbor" policy.

Great powers have frequently intervened, sometimes collectively, to prevent a state from getting so powerful as to disturb the balance of power. A system of international relations based on an equilibrium of power can hardly avoid occasional interventions of this kind. Intervention to stop gross inhumanities against minorities or dependent peoples have also occurred, and have been considered justifiable if the purpose was genuinely humanitarian. Often such interventions have veiled political purposes.

The League of Nations Covenant declared that "the League shall take any action that may be deemed wise and effectual to safeguard the peace of nations," and the United Nations Charter gives the Security Council "primary responsibility for the maintenance of international peace and security." Action authorized in pursuance of these provisions has sometimes been called "collective intervention," and is undoubtedly legal if in pursuance of the authority given the organization by its members.

The problem of preventing circumstances from arising which will induce states to intervene in the affairs of others is the major problem of international law and international organization, and can hardly be solved without in some degree subjecting the sovereignty of states to the world order. Nations continue reluctant, however, to surrender their sovereignty in this manner.

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INTESTACY, the legal state of a person dying without having disposed of his property by last will and testament. In Britain, formerly, intestacy did not affect real estate, which was disposed of in accordance with the rule of descent. Legislation, which became effective there on Jan. 1, 1926, provided that both real and personal property shall devolve in the same way. The effect of intestacy in the United States varies in accordance with the laws of inheritance fixed by each of the states. Intestacy may be complete, as when a valid will is not left by the dead proprietor; or partial when the extant will only provides for the distribution of part of the property where a testator failed to make a residuary clause. In these cases the property passes to the heirs or next of kin of the decedent in accordance with the laws of the place where the property is.

The distribution under intestacy by the statutes of the various states of the United States may vary, but as an example in a common situa-

tion when a deceased is survived by husband or wife and children, one third of his estate is apportioned to the surviving husband or wife, and the remaining two thirds is divided equally among the children. Should there be a predeceased child with three grandchildren, such grandchildren would take the share of the predeceased child per stirpes, that is, a distribution by representation.

Actually, the law of the state makes the will of the decedent in cases of intestacy. The necessary steps for the administration of the property of an intestate is begun by filing a petition for letters of administration, obtaining jurisdiction of the necessary parties, and the issuance of the letters by the surrogate. There being no executor, the surrogate appoints an administrator, usually a person interested in the protection and conservation of the property. The surrogate may require the administrator to file a bond for the faithful performance of his duties. Usually those most closely related to the deceased are entitled to receive letters of administration in preference to one who is not so closely related. See DESCENT AND DISTRIBUTION; HEIR; INHERITANCE.

INTESTINE, BOWEL, or GUT. In man and the higher animals, that portion of the alimentary tube or canal lying between the stomach and the anus. The human bowel is divided into a small and a large intestine, the two parts varying in structure, movement, and function. The small intestine originates at the pyloric end of the stomach, and its first 8 to 10 inches form the duodenum. This section is divided into several [usually four] different portions and lies deeply within the upper abdominal cavity, embracing the head of the pancreas. Some 4 inches below the pylorus, is situated the opening of the common duct of the gall bladder and the pancreas through which bile and pancreatic juice are discharged into the intestine. At its end, the duodenum merges with the jejunum, the name applied to the upper two fifths of the small intestine, the lower three fifths being known as the ileum. Differences in gross structure of these two portions of the small intestine are not marked immediately, and only in its lower or terminal end does the ileum show distinct characteristics and definite changes. In general the jejunum is to be found in the left and upper portion of the peritoneal cavity, and has thicker walls than the thinner ileum, which occupies the lower portion of the belly cavity. The lumen of the small intestine, from the duodenum down, gradually becomes less, so that at the cecum its diameter is but little more than an inch as contrasted with nearly two and one half inches in the duodenum. The ileum is inserted at a point several inches above the lower limit of the cecum, which is the actual beginning of the large intestine. The cecum itself is a blind pouch lying in the lower right portion of the abdominal cavity, from which it continues upward as the ascending colon as far as the under surface of the liver. There it becomes the transverse colon. At its lower and posterior portion the cecum gives off a functionless organ well known to fame, the vermiform appendix (see APPENDICITIS). From its beginning near the liver and gall bladder, the transverse colon passes across the peritoneal cavity, within the folds of the great omentum and beneath the lower border

of the stomach, to the region of the spleen, where it turns downward at the splenic flexure, continuing its course as the descending colon. As it descends it becomes curved, somewhat like the letter S, forming the sigmoid flexure, the beginning of the rectum. The latter passes over the brim of the bony pelvis deep into the pelvic fossa, ending at its outlet, the anus (see COLON; RECTUM). The small intestine is usually about 23 feet in length, the large bowel being about 5 feet. In anatomical structure both portions of the alimentary canal have four coats, known from within out as the mucous, the submucous, the muscular, and the serous or peritoneal. The muscular layers contain both longitudinal and encircling fibers which by their contractions accomplish the movement known as peristalsis. In the small intestine, which is concerned largely with absorption of nutrient material, the result of digestive processes, the mucous membrane is thrown up into permanent folds or rugae, each extending more than halfway around the inside of the bowel, the result being that a large area is provided for absorptive processes. The inner surface is provided with minute, fingerlike projections called villi, each having a large absorbing vessel in the center. At the bases of the villi are tubular and branching glands [of Brunner and Lieberkuhn] that penetrate deep into the mucous membrane. Scattered irregularly over the surface are small collections of lymphoid tissue [the so-called solitary follicles]. In the ileum these follicles form collections known as Peyer's patches, and it is these which are attacked in typhoid fever, being the site of ulcers and occasional perforations. The muscular coat of the bowel already mentioned consists of two layers: an inner one, running about the circumference of the intestine; and an outer one, or longitudinal layer. The large bowel or colon has neither folds nor villi, its absorbing power being mainly for water. It is not as movable as the small intestine since it is fixed to the posterior wall of the peritoneal cavity except in the transverse portion, which has considerable mobility. The entire bowel is well supplied with a network of blood vessels contained within the mesentery or supporting peritoneal fold, by which it is attached to the posterior wall of the abdominal cavity. It has also a complicated nerve supply governing its secretory function and peristaltic action (see PHYSIOLOGY).

Diseases of the Intestine.—Intestinal diseases should be considered as including all disturbances referable to any part of the small or large bowel, from duodenum to anus. The general and all-inclusive term for these maladies, or at least most of them, is intestinal dysfunction. Interference with normal function of the intestine does not mean necessarily the existence of any structural change in the organs involved. Many manifestations, such as constipation, diarrhea, distention, abdominal pain, and so on, may be of reflex origin and may show no evidence of actual pathology. For this reason, intestinal indigestion, intestinal stasis, dyspepsia, and the like must be considered as vague terms which fail to describe a particular disease. Any classification of intestinal diseases of a medical or nonoperative nature will include constipation, diarrhea, intestinal neuroses, melenema, fatty stools (steatorrhea), food poisoning (ptomaines, botulism), ulcerative colitis, diverticulitis, and

perhaps regional ileitis, to mention some of the more important. Some of these medical conditions may become of surgical interest in certain cases.

The occurrence of intestinal parasites does not of itself constitute a disease but merely an infestation of the intestinal tract which may cause symptoms. Among surgical conditions affecting the intestine may be listed appendicitis, intestinal obstruction, tuberculosis, and malignant tumors. Regional ileitis is also of surgical importance. Gastric and duodenal ulcers [peptic ulcer], duodenitis, and hemorrhoids should be regarded as pertaining to pathologic conditions of the stomach and anus, respectively, rather than to the intestine itself (see *STOMACH*; *ANUS*; *HEMORRHOIDS*).

Constipation.—This is a functional disorder, and does not constitute a true disease, since it is caused by some disturbance of the regulatory mechanism of the bowel. It may be acute or chronic, and the portion of the bowel involved is usually the colon and especially the rectum, and not the small intestine. Among many conditions responsible, any or all of which may be present, may be mentioned insufficient fluid intake, improper diet, lack of exercise, careless and irregular bowel habits, and the abuse of laxatives (see *CONSTIPATION*).

Diarrhea.—This is the reverse of constipation, and is not a disease but a symptom. The acute variety may be the result of infection involving the intestinal tract, such as food poisoning, bacillary dysentery, amebic dysentery, ulceration of the colon, infestation by intestinal parasites which cause irritation, and the like. It may arise also from ingestion of irritative metals, such as arsenic, lead, and mercury. The cause of the chronic form is often obscure and difficult to determine and must be sought for among a host of diseases, including ulceration of the colon from tuberculosis, bacillary dysentery, pernicious anemia, leukemia, sprue, hyperthyroidism, and malignant disease of the colon although the last is usually associated with constipation. The underlying cause must be ascertained before effective treatment can be instituted.

Neurosis as Cause of Intestinal Disorder.—Neuroses, manifested by bowel dysfunction, are extremely common. They are often disposed of by such terms as indigestion, spastic colitis, mucous colitis, and irritable colon. Many persons afflicted with a neurosis, who are really not at all ill, become "bowel conscious," fretting over the mildest of symptoms and examining each stool with meticulous care and anxiety. Frequently such persons regard mucous, a constituent of normal colons, as indicating the presence of disease, and it is difficult to wean them from this belief. In spite of the chronicity of most neuroses and the complaints of those having bowel symptoms, the lack of interference with the general health of those affected, together with the fact that no blood, pus, or parasites are observed in the stools, furnish strong evidence against the presence of any actual disease.

Melenema.—This is a general term to indicate the passage of blood from the anus, and is not in itself a disease. The symptom may be discovered by accident, is often unaccompanied by pain, and is not noted in many cases since the individual may not see his bowel movement.

If the passage of blood be considerable it will cause a feeling of uneasiness and perhaps of faintness. In any event, the symptom is to be regarded with seriousness. Unless the loss of blood can be established by examination as coming from hemorrhoidal veins at the anus (piles), the cause should be searched for until it can be ascertained with certainty. The commonest sources of bleeding outside of hemorrhoids are anal fissure, rectal ulcer, and malignant tumor of the colon and rectum. Occasionally blood will issue from portal obstruction in the liver or from ruptured hemorrhoidal vessels high in the colon as a result of far advanced arteriosclerosis. Blood arising from the stomach, duodenum, and biliary passage is generally dark in appearance, due to partial decomposition in its passage through the digestive tract (so-called tarry stools).

Colitis.—Inflammation of the colon, of any degree of seriousness other than that arising from causes already mentioned, is generally chronic. In course of time the colon becomes congested and its mucous surface eroded. In advanced cases these eroded areas or ulcers show deep craters, and the diseased areas may coalesce to form a single large ulcer. Eventually the bowel becomes indurated and inelastic, with a considerably narrowed lumen. Symptoms may persist for years, with gradual decline in health and marked loss of weight. The disease is not particularly common, and is confined largely to elderly people. Another disease seen in this age group is diverticulosis [dilatation of the colon in certain areas] and its companion diverticulitis. The latter may become serious, and may necessitate surgical intervention if an abscess forms or if the area becomes the seat of malignant tumor.

Regional Ileitis.—This is a nonspecific, granulomatous, inflammatory disease involving the terminal ileum. Although it had been recognized many years before, the disease was first described adequately in 1932. At first thought to be rare, it is now regarded as fairly common. No single bacterial, virus, or chemical agency can be assigned as a cause. The disease resembles tuberculosis of the bowel and also certain forms of dysentery. While localized generally in a small section of the ileum, several feet of small bowel may become involved after several years, the process even extending to the jejunum. It is frequently complicated with other intestinal diseases and with intestinal fistula. It has been mistaken for acute appendicitis. The symptoms are abdominal pain, distention, failure of digestion, and loss of weight, together with recurring attacks resembling intestinal obstruction. After a considerable period of months or years the segment of intestine affected loses its elasticity and becomes cicatrized and inelastic, so that it is practically functionless. The diagnosis is suggested by the symptoms, and especially by the presence of an abdominal fistula which refuses to heal. It is confirmed by X-ray findings. The treatment is not always successful. Medical treatment is directed usually to diet, which must be such that the damaged bowel will absorb it with the least irritation possible, and to the administration of chemical foods by mouth or by injection into the circulation if nourishment cannot be borne by the usual channels. Surgical treatment may involve resection of the diseased intestine in part, or anastomosis of the intestine

so as to bypass the diseased segment, allowing the intestinal contents to pass through healthy intestine and leaving the diseased loop in situ.

Acute Appendicitis.—This is a bacterial infection often followed by suppuration (perforation) of the vermiform appendix (see APPENDICITIS).

Intestinal Obstruction.—This is an extremely acute intra-abdominal calamity of the utmost gravity. Its causes are manifold, including constriction of the bowel from pressure (such as bands of tissue which compress it), hernia (in which a loop of small intestine is held prisoner by the hernial ring so that it cannot escape into the abdominal cavity), intussusception (the telescoping of one loop of bowel into another; seen most often in infants), narrowing of the lumen of the bowel from any cause (as malignant disease or the action of caustics), impaction of feces, pressure of huge collections of gallstones, foreign bodies lodged in the intestines, and masses of intestinal worms. Still other causes, often most difficult of diagnosis, are thrombosis and embolism of a vessel supplying a segment of intestine and resulting in localized intestinal gangrene from failure of the blood supply. Any obstruction of the small bowel, whether from pressure, circulatory failure, or of mechanical or static origin, will result in an alarming train of symptoms. There is severe abdominal pain, vomiting (after several hours), which in late stages becomes fecal, abdominal distention without relief though bowel movements or the passage of gas, and mounting toxemia and prostration. If unrelieved by surgery within a short time of onset, the patient succumbs. The object of surgical intervention is to relieve the obstruction wherever it is found and to aid the paralyzed bowel to regain its tone and function. The toxic obstruction following operations (especially where peritonitis is present [ileus] in which the small intestine is paralyzed), is susceptible of relief through the use of lavage, using a special nasal rubber catheter running to the duodenum, maintained in place in connection with a negative pressure apparatus which keeps the stomach empty until the paralyzed bowel begins to function. Chronic intestinal obstruction involves usually the large intestine. If caused by foreign bodies or impacted feces, it is often relieved by simple measures. If the foreign body cannot be removed thus, or if a tumor be present, appropriate surgical intervention is indicated, according to the nature of the case.

Malignant Disease of the Intestine.—This is confined almost entirely to the colon and rectum. There are comparatively few tumors of the intestinal tract which are nonmalignant. Most new growths of the bowel are carcinomatous or adenocarcinomatous. A favorite site is the sigmoid colon, with the rectum next in order of frequency. Fortunately for the success of surgery, most tumors of the colon can be diagnosed and attacked before metastasis has occurred to other parts of the body. However, not all cancers transfer cells late instead of early, and operative interference should never be delayed unduly. The most favorable time is when the diagnosis is made and the surgeon indicates he is ready. The symptoms of intestinal cancer are often unnoticed or given only slight attention by the patient, since they are apt to be general. Thus gradually increasing and obstinate consti-

pation is the rule. There is gradual but steady loss of weight, increasing pallor and failure of strength, not to be accounted for by the everyday life of the patient. Anemia develops and then cachexia, the latter becoming so noticeable that acquaintances will remark it. Sometimes, but by no means always, a tumor can be felt through the abdominal wall. Occasionally, blood will be seen in the bowel movements. Diagnosis can be made usually by rectal or sigmoidoscopic examinations, supplemented by X-ray studies. The course of the disease is a few years at most unless resection of the diseased bowel can be done, with removal of the tumor and providing for end to end anastomosis; or if that is impossible and the anus must be removed with the diseased rectum, an artificial anus. If the operation can be completed before transference of malignant tumor cells to other locations has occurred, a complete cure is generally possible.

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INTIMIDATION. See CORRUPT PRACTICES ACTS.

INTONING, the practice of delivering prayers in the recitative form. Intoning differs little from chanting: in the latter case the cadence is more developed, the divisions more rhythmical, and the music in continuous harmony. In intoning the greater part of the prayer is recited on one note and then sung by several voices in unison, the closing words of the sentence being sung to the proximate notes of the scale and in harmony.

INTOXICATION (literally poisoning, commonly restricted to poisoning by means of alcohol, for a discussion of which latter see ALCOHOLISM). Intoxication in the sense of poisoning may result from poisons having their origin outside of the human body (exogenous poisoning), or from poisons which may be developed within the body itself (endogenous poisoning, or auto-intoxication). Some of the most important problems connected with the infectious diseases concern themselves with the study of the intoxications that result from the formation of toxins by specific bacteria distributed throughout the human body during the course of a disease. From the same point of view many of the most complicated intoxications result from variations in the normal metabolism of the body. Thus, in diabetes mellitus (q.v.) there is developed an acid intoxication (diabetic coma), which is due to the inability of the body properly to neutralize by its alkaline salts the excessive amounts of acid produced as a result of the perverted metabolism of this disease. Similarly, in Bright's disease a type of intoxication (uremic poisoning) results from failure of the kidneys to eliminate poisonous products from the human body.

INTRENCHMENT, in fortification, any work, consisting of not less than a parapet

and a ditch, which fortifies a post against the attack of an enemy. As a means of prolonging the defense in a regular work of permanent fortification, intrenchments are made in various parts, to which the defenders successively retire when driven in from forward works. Bastions are ordinarily intrenched at the gorge by a breast-work and ditch, forming either a re-entering angle or a small front of fortification. An army in the field often strengthens its position by intrenchments, as by a continual line of parapet and ditch, or by a line with intervals, consisting of detached works of more or less pretension flanking each other. The war in Europe, which began in 1914, was marked by an unprecedented system of intrenchment, with shelters, dugouts, barbed wire obstacles. See FORTIFICATIONS.

INTRODUCED SPECIES. A long catalogue might be made of species of animals and plants which have been transferred by accident or design from their native country or locality to other regions. Sometimes, as in the case of salmon in New Zealand, rabbits in Australia, the European house sparrow in America and elsewhere, or Western fishes in Eastern waters, this is done by design; but in the great majority of cases the introduction is accidental and unwelcome, as in the case of the hundred and more species of injurious insects brought into the United States from foreign lands (or the fewer sent abroad from here), and the very many species of "weeds" naturalized on our and other shores. Such introductions are in the main accidental, the eggs or seeds or grown individuals passing from one region to another in ships or railway trains, or cargoes or discharged ballast; so many plants have been introduced by the latter means that botanists class the group of alien weeds as "ballast plants." See also ACCLIMATIZATION; MIGRATION OF ANIMALS.

INTROIT, in-trō'it (from the Latin *introdūcere*, to go into, to enter). An antiphon and psalm sung by the choir at the beginning of the Mass. The text of the antiphon, or introit proper, varies with the days of the ecclesiastical year, but is almost always drawn from Holy Scripture. From the opening words of these introits many Sundays derive the names by which they are popularly known, such as Laetare, Gaudete, or Quasimodo Sunday. Originally the introit was in the form of an entire psalm, preceded by an antiphon, but now it has been shortened so that only one verse of the psalm is sung, followed by the *Gloria Patri* and a repetition of the antiphon. Other names for the introit are *ingressa* (Ambrosian); *praelegere* (Gallican); and *officium* (Mozarabic).

INTROSPECTION, a method of observing and analyzing one's own mental states and processes, his thoughts and feelings. Suppose that one has a mental picture of yesterday's scene or has a feeling of impatience: if he notes this awareness and subjects it to examination, he is introspecting. This had been the psychological method par excellence until the last two or three decades. Two theoretical challenges of the validity of the method were recognized and met. One was that the very turning of a person's attention upon his feelings and train of ideas is likely to interfere with the natural flow of such processes. Another was that in the very act of attending intellectually to a present

state of mind, he inevitably changes its very character. To both challenges the answer was that introspecting properly includes much retrospect, much recalling of the immediate past; and so the particular character of the just-recalled is not essentially altered.

To use the introspective method requires long training. One error of the untrained is that he often confuses what he knows about the external source of stimulation with the description of his sensory experience as such; that is, he may be thinking too much about the coated papers he is looking at and too little about the colorful experiences he is having, just as colors.

Techniques became highly refined in the Wilhelm Wundt tradition. States of awareness were formally broken down into what were held to be their component elements. The perceptive awareness of an architectural column—to employ an example—might be analyzed first into two sensory modalities, the visual and the muscle-sense. These were further identified as possessing particular attributes of quality, intensity, duration, extensity. The visual appearance of the left-hand side might be of brighter hue, the views obtained by right and by left eye might vary in their exact spatial extent, the slight muscular strains as the observer shifts his regard from column to background and back again might become noticeable enough as he attends to them, and numerous other sensory characters might be brought out in this way. In addition, the experience as a whole might be toned agreeably, this agreeableness being of moderate intensity and diffused. From such an example it is seen that the traditional use of introspection was oriented toward analysis primarily.

An expanded method of introspection was that adopted by Oswald Külpe and his followers by which they reported their totality of experiences of the moment; and they were apparently rewarded by the discovery of other kinds of awareness than those admitted by the orthodox schools, including thought processes that went on consciously but without any imagery.

Although it has been used in a different historical context, the term "phenomenological" has much in common with "introspective." Consistently with the etymology of the word *phenomenon*, which means "appearance," *phenomenology* is the study of immediate experience at its face value and purely descriptively. The term has been adopted by several psychological and philosophical schools, which take their various departures from an attempt at "pure experience," "immediate experience." In this generic sense, phenomenology may be thought of as including the more specialized introspection.

The length of the training and the unusual character of the methods led the behaviorists to charge that the introspective procedure was esoteric. And at all events, contemporary psychologists ordinarily employ a person's introspections as strictly ancillary to the objective observing of his behavior.

See also THOUGHT.

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INTROVERSION, in-trō-vūr'shūn, in psychology, a characteristic style of personality adjustment in which the center of interest lies in the individual's own mental life and not in the environment or in other persons. The introvert is withdrawn, thoughtful, and deliberate in making decisions. He does not like exuberant amusements, stories of daring adventure, or activities which call for display of skills before large audiences. He does not depend for his satisfactions upon approval from others, upon a wide circle of acquaintances, or upon gay parties. He derives satisfactions from performances which meet his own expectations; from a few well-chosen friends; and from quiet, even solitary, recreation. He has what William James once referred to as "aseity"—that is, self-sufficiency.

John Milton distinguished between two types of men—one type being happy, ebullient, active in the search for associates (*L'Allegro*); the other, stable in emotions, reserved in manner, and happiest when engaged in study or in solitary contemplation (*Il Penseroso*). The ideal day which each of these men enjoyed conforms, in many ways, to popular concepts of the extrovert and the introvert. Personality inventories have been constructed to test whether one is extroverted, ambiverted (that is, midway between the extremes), or introverted, and to what degree. Such questions as these are usually included, to all or most of which an introvert would answer "Yes":

Do you often cross the street to avoid meeting someone?

Do you prefer novels or plays which analyze the motives of characters?

Would you be embarrassed if suddenly asked to be "stunt leader" at a large party?

Are you able to spend evenings at home and alone without being bored?

In company, would you prefer to listen than to be the center of attention?

Carl Gustav Jung, founder of analytical psychology, developed an elaborate and complex system for "typing" persons. First, he said that everyone has a dominant psychic attitude along the personality dimension of introversion-extroversion. This is determined by the manner in which all energies are directed, whether toward the self or toward the outer world. Secondly, there are four ways of functioning. A person may be concerned with the immediate aspects of a situation (*sensation function*); with the antecedents and the possible consequences of the situation (*intuition function*); with judgments of values (*feeling function*); or with abstract concepts (*thinking function*). There may be a harmonious relationship among the dominant psychic attitude and the four ways of functioning; then, according to the Jungian analysts, the individual would be in good mental health. A lack of balance, however, would create more or less maladjustment.

Suppose, for example, a fervent introverted reformer has disharmonies among his functions. *Thinking* might lead him to untenable opinions; *intuition* ("hunches"), then, could make his speeches incoherent and disorganized; *sensation* might cause his message to lack perspective; and *feeling* could lead him to purposeless endeavors. The Jungian analyst would be confronted by the problem of restoring the balance among these functions, a process that could take a long time. He certainly would object to the use of oversimplified inventories which are based upon a superficial and mistaken knowledge of what Jung

actually taught about introversion and extroversion.

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INTRUSION. See ROCKS.

INTUITION, in-tū-ish'ūn, immediate or direct knowledge, apprehension, or understanding; awareness as if by unimpeded sight or grasp of the object, rather than reflection about it. Intuition is variously contrasted with one or more of the following kinds of indirectness or discursiveness: (1) inference or interpretation; (2) symbolism or representation by words or ideas; (3) formulation in judgment, with subject and predicate; and (4) analysis to constituents. The word is thus applied to mystical vision, to religious inspiration or illumination, to the moral sense, to acquaintance with one's self and inner states or acts, and to sensitivity to the thoughts, feelings, and intentions of other persons, as well as (generally now only by philosophers) to the purely sensory component of perception. In all these the knower is primarily passive or receptive, and the object is a particular or individual, more or less concrete, while the experience is more or less incommunicable. Philosophers, logicians, and scientists, however, speak also of intuitions of universal essences (Edmund Husserl and George Santayana, for example), and of intuitions of very general abstract truths, thus connoting sometimes the self-evidence of a principle which has become perfectly clear to the mind (René Descartes, Baruch Spinoza, John Locke, Sir William Hamilton), and sometimes the "hunch" or insight by which a formal conclusion is conceived and felt to be correct in advance of proof. The last use is common to scientific and logical writings and ordinary speech ("woman's intuition"). For a famous and distinctive philosophical doctrine of intuition, see BERGSONISM.

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INUKAI, è-nōō-kī, Ki Tsuyoshi, Japanese journalist and statesman: b. Okayama-ken, Japan, April 1855; d. Tokyo, May 16, 1932. After graduating from Keio University, he became a correspondent and then editor of the newspaper *Hōchi Shimbun*. In 1890 he was elected to the Japanese Diet, where he served continuously throughout the remainder of his life. He held the positions of minister of education in 1898 and minister of communications in 1924–1925, and in 1929 became the president of the Seiyukai Party. On Dec. 13, 1931, he was elected premier of Japan, and his party won an overwhelming majority in the Diet the following February; however, a strong militaristic faction, already in control of Manchuria, became angered by his peaceful policy toward China and three months later caused his assassination, thus ending effective parliamentary government in Japan until after World War II.

INULIN, in'ū-lin, a chemical substance resembling starch, derived from the roots and bulbs of several plants, including *Dahlia variabilis*. A lumpy, white powder, it has a formula of $(C_6H_{10}O_5)_n$ and is used in the manufacture of diabetic bread and of fructose.

INUNDATIONS. See FLOODS AND INUNDATIONS.

INVALIDES, ān-vā-lēd', *Hôtel des*, one of the most beautiful monuments in Paris, France. It was founded by Louis XIV in 1670 as a residence for old and wounded veterans of the French armies. Opened in 1675, it accommodated 6,000 officers and men. For a while it served as a place of retirement for the aged servants of court favorites as well as the disabled soldiers, but this abuse was ended by the Comte de St. Germain in the reign of Louis XV. It is now supported by the state. The architect of the hotel and chapel was Libéral Bruant. The general design of the building, in the shape of a Greek cross, is vast and notable for its symmetry and simplicity of line, its harmonious use of space, and its many sumptuous galleries and porticoes. The dome of the chapel was built by Jules Hardouin Mansard. An elegant, magnificent construction, it is an example of classic majesty without heaviness, and sets off the gracefulness of the building. Under that high gilded dome are the tombs of the Vicomte de Turenne, the Marquis de Vauban, and Jérôme and Joseph Bonaparte, and, in the center, twenty feet below the floor of the church, the tomb of Napoleon I, whose remains were brought to France from St. Helena in 1840. Napoleon's mausoleum is surrounded by 12 colossal statues, commemorating the 12 principal victories of the emperor. The statues, the pillars, and the cornice are made of white marble.

INVAR, ĭn-vār, a trade name for an alloy containing 34 to 36 per cent nickel (the balance made up of iron), characterized by its extremely small coefficient of thermal expansion, with good strength and endurance at elevated temperatures. Because of its very small change of dimension with temperature, the alloy is used for measuring tapes, precision components for machines, and pendulum rods. The International Bureau of Weights and Measures has adopted Invar as a length standard. The high polish attainable and the corrosion resistance of the alloy are added assets.

One of the principal uses of Invar is as a bimetal. A bimetal is a composite metal, half of whose cross section consists of a metal with a high-temperature coefficient of expansion and half of a metal with a low-temperature coefficient of expansion. As the temperature changes, the difference in expansion causes the composite metal to bend. If one end of the bimetal is fixed, the curvature occurring with changes in temperature may be made to cause deflection at the free end which could operate electrical contacts. In temperature indicators, where a large deflection is desired, the bimetal may be in the form of a helical spring. When the outer end is fixed, the inner end can be attached to a shaft which will then rotate with changes in temperature. Two widely used bimetal composites with high sensitivity at room temperature are brass-Invar, and silicon bronze-Invar, the Invar serving as the low expansive side. Austenitic corrosion-resistant steel can be substituted for the copper alloys on the high expansive side and used with Invar at high temperatures where better stability and greater resistance to failure by overheating are desired.

ALVIN S. COHAN.

INVASION, ĭn-vā'zhŭn, in military affairs, the unauthorized entry of armed forces of a nation into the territory or possessions of another. When the invasion is abrupt and hasty (for ex-

ample, the German invasion of Norway in 1940) it is termed an *incursion*; when undertaken with particular violence (the German invasion of Poland in 1939) it is referred to as an *irruption*. Invasions may be undertaken (1) to conquer and absorb another nation; (2) to overthrow the existing regime and substitute a friendly puppet government; (3) to conquer territory desired for national expansion; (4) for economic gain, or to enforce economic cooperation (Napoleon's invasion of Russia in 1812 to impose acceptance of his Continental System); or (5) to assist or free a conquered ally (the Allied invasion of France in 1944). An invasion usually precipitates a war. When wars could be limited without endangering entire populations, as in the 18th century, invasions could be undertaken purely with a profit motive to annex adjacent provinces or to exact tribute. With the subsequent development of total war and its detrimental consequences for victor and vanquished alike, invasions were not undertaken with impunity. In mid-20th century, the possibility of mutual extinction through the use of nuclear weapons of tremendous power acts as a deterrent to invasion by armed forces which would precipitate a general war. Instead, the objectives of invasion are being sought by means not likely to create a formal state of war—the "cold war" with its infiltration, attempts at subversion, and its ideological struggle for the mind of man. The initiation of a formal state of war has been avoided by the subterfuge of invading with so-called "volunteer" forces—forces denied as official components of a nation's armed forces and depicted as groups of individuals volunteering to aid a friendly state (the Chinese Communist operations in Korea in 1950–1951).

VINCENT J. ESPOSITO.

INVENTIONS. Inventions are new concepts, new combinations of known elements, new techniques of action that can become an integral part of the knowledge and skills with which we can use natural resources and the forces of nature. We frequently contrast invention and discovery, but there is little gained in attempting a formal distinction between these terms. New concepts are ordinarily little more than the first step toward the construction of new apparatus. New understanding of the principles of optics led directly to the construction of compound telescopes and microscopes. The measurement of air pressure and the analysis of the vacuum led after an interval to the effective use of steam. The emergence of novelty is the important fact, not the form or level at which it occurs. In the study of inventions, however, it is necessary to recognize that the individual item of novelty is small, and that we commonly fail to distinguish between a particular invention and the long sequence of earlier inventions to which it gives new and conspicuous meaning. Thus, James Watt's conception of the condensing engine in 1765 rested upon the whole sequence of scientific and mechanical efforts that began in 1644 with Evangelista Torricelli's analysis of atmospheric pressure and the phenomena of the vacuum. Inventions are not isolated, or detached items, but steps in a coherent process of cumulative synthesis. Our science and technology are thus, the consequence and summation of our cultural history. The heritage reaches back to the preliterate cultures of the Western World, though few devices are still in use that go back to the beginnings

of cereal growing and settled agriculture, about 8000 B.C. The potter's wheel is, perhaps, the outstanding example of a device that has survived the centuries of progressive sophistication with no more than incidental modification. Massive accumulation does not begin prior to the development of science in Mesopotamia, Egypt, and Greece in the 5th and 6th centuries B.C.

Technology in Antiquity.—Our knowledge of technology in this early period rests upon archaeological evidence supplemented by treatises and literary references. We are rarely able to identify individual inventors or inventions. The water screw is commonly attributed to Archimedes (287–212 B.C.), but some writers confidently assume that it was used much earlier in Egypt, though no pictorial representation is cited. Two inventions, the force pump and the water organ, are credited to Ctesibius (300–220 B.C.), the author of a lost treatise, preserved in part by the work of his pupil Philo of Byzantium. These attributions are probably justified; both mechanisms involve important new principles which are closely related to the field of interest covered by the treatise of Philo. They are not likely to be earlier, but they may never have been built. The water wheel shown by Philo to work a chain of pots to raise water may be just a concept. The type of wheel shown cannot be identified with either of the types that came into use at the close of the pre-Christian era. The treatise contains some new concepts, some new inventions, and some descriptions of known mechanisms.

The outstanding inventions of antiquity were two types of water wheels; a number of applications of large screws; several applications of gears and worms; an array of cranes; a variety of small devices to use pressure media; and two major developments of the loom. For descriptions of these devices we are largely dependent upon the treatises of Vitruvius (fl. 27 B.C.–14 A.D.), and Hero of Alexandria (1st century A.D.).

A small water wheel was invented in Greece, probably in the 2d century B.C. It was a very simple device. Four or more paddles were attached to a shaft which turned the upper millstone. The mill could be made by any carpenter, and required little skill from the operator. We know little of the history of this mill in Greece, but it came into extensive use in northern Europe as early as the 4th century A.D. A larger mill is first described by Vitruvius, and is commonly presumed to have been invented only a short time before the composition of the treatise. This mill had a relatively large wheel set vertically in the stream. It could be used as an undershot wheel, an overshot wheel, or as a breast wheel. The power from the wheel was transmitted to the millstone by a shaft with gears, or a toothed wheel and a rundle. This water wheel came into extensive use in the 3d century A.D. in Rome itself, and in some of the provinces, notably at Arles.

Gears also appear in other mechanisms. Hero of Alexandria described a cyclometer to measure distances. The device combines gears with worm drives on axles to connect the measuring wheel on the road to the counting dial which registers the distance traversed. Gears were also applied to the control of a surveying instrument called the dioptra. No lenses were used, but the parts of the instrument were fully controlled by the gearing. Heavy-duty screws of wood were applied to wine and olive presses, and also to

a lighter model for cloth. A device for cutting wood screws is shown by Hero, though the larger screws were generally cut with hand tools.

Both Vitruvius and Hero describe cranes of various types, but there is archeological evidence of earlier use. The word for pulley appears in Mesopotamia as early as 1500 B.C., and pulley wheels of wood have been found at Nimrud (c. 900–700 B.C.). The stones for the lintels in the Greek temple at Bassae (5th century B.C.) have slots for the use of lifting devices which imply some form of crane. The pneumatic devices described by Hero embody important principles, though in antiquity they were applied to the manipulation of figurines for the amusement of spectators, or as some feature of temple service.

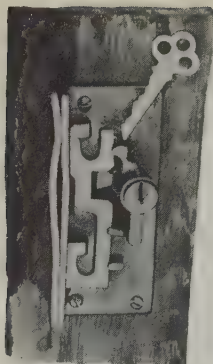
From archaeological sources, we know that the loom with four or more heddles and the draw loom appear in Syria shortly before the close of the pre-Christian era. The loom with heddles is presumed to be a Syrian invention, and the serge weave is certainly Syrian in origin. The draw loom, figured weaves, and the satin weave came from China.

Medieval and Renaissance Technology.—

After the fall of Rome, the history of technology was dominated by the diffusion and development of the major inventions of the last three centuries of the ancient world. New work was not urgent. However, in one field important new developments occurred. Horses and mules had been used in antiquity, but the harness was ill designed, and no successful protection had been provided for their feet. After some improvements in the breastplate, the harness for draft horses was finally perfected by the introduction of the padded collar fitted to the bones of the neck (9th century A.D.).

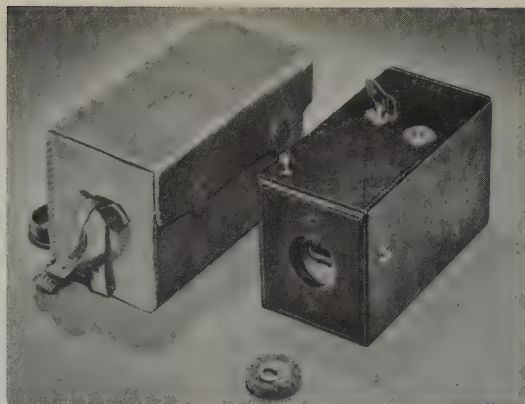
The invention of the mechanical clock was the greatest achievement of the Middle Ages. Water clocks were widely used in cathedrals and monasteries, and these clocks have frequently been confused with mechanical clocks, but it is now recognized that there was no mechanical clock earlier than the second quarter of the 14th century. The clock erected in Milan in 1335 is the first that can be certainly identified as a mechanical clock. Jacopo di Dondi built a clock in 1344 at Padua, and clocks were built at Modena in 1343 and at Monza in 1347. In 1348, Giovanni di Dondi began an astronomical clock that was finished in 1364. This was fully described in a treatise that is still extant. The clock built by Henri De Vick in Paris in 1370 is still in place on the tower of the Palais de Justice, though the movement was extensively repaired in 1760 by Pierre Leroy. Its original condition was described in detail by him, with good drawings. Early clocks that have survived were modified by the addition of a pendulum after the time of Christian Huygens.

The invention of printing in the 15th century is another basic achievement. We have many specimens of early printing, but our knowledge of the techniques used is incomplete. The crucial problem was to produce good type. The records are confusing, but it is clear that Johann Gutenberg's great invention was the adjustable type mold. This may have been achieved as early as 1439 at Strasbourg, and in any event at an early date after Gutenberg came to Mainz, possibly in 1448. A number of improvements in type founding were developed soon after the invention of the type mold, and some details of the press



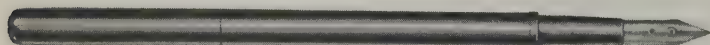
Yale & Towne

Early Yale tumbler lock, 1860



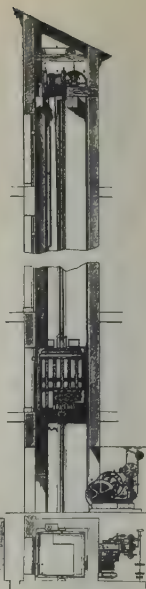
Eastman Kodak Company

First Kodak camera, 1888



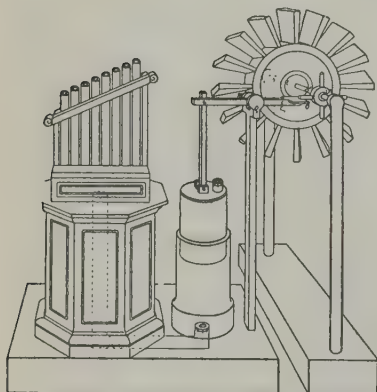
Waterman Pen Company

First practical fountain pen, 1884



Otis steam elevator, 1861

Otis Elevator Company

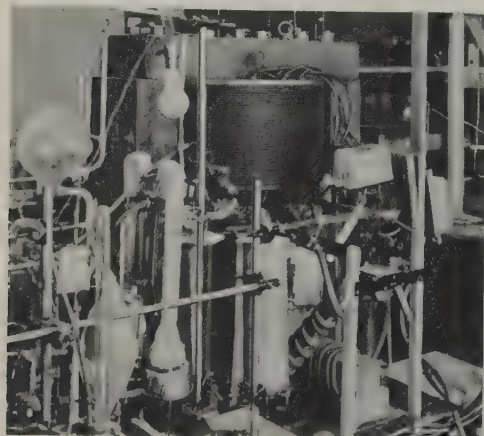


Ctesibius' hydraulic organ (200's B.C.)*



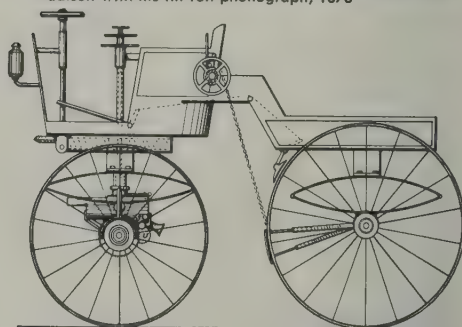
Edison Laboratory National Monument

Edison with his tin-foil phonograph, 1878



University of California

Lawrence cyclotron, 1931



Automobile Manufacturers Association

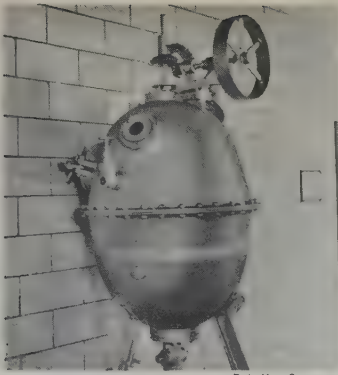
First gasoline-powered automobile, 1895



International Harvester Company

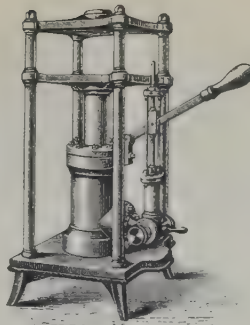
McCormick's first reaper, 1833-1834

* From "A History of Mechanical Inventions,"
by Abbott Payson Usher, Harvard University Press



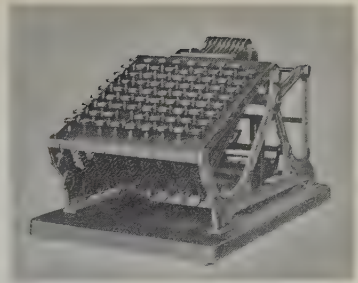
Bakelite Company

Original still for making plastics, 1907



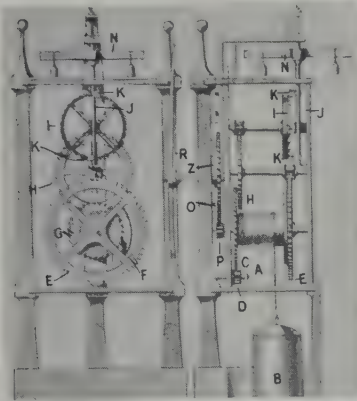
Culver Service

Early hydraulic press, 1795

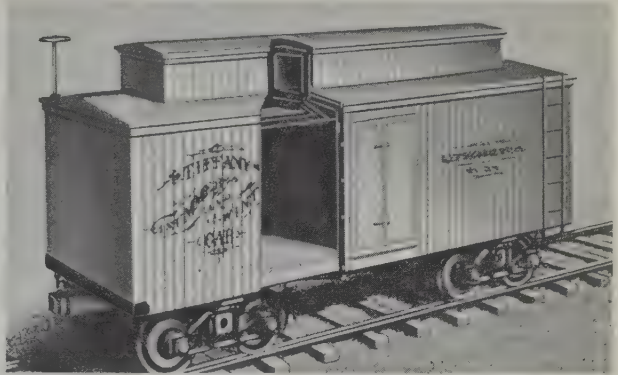


Burroughs Corporation

First practical recording adding machine, 1888

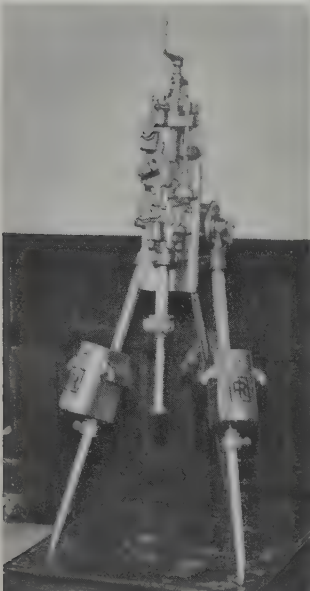


Mechanism of de Vick's clock, 1370 *



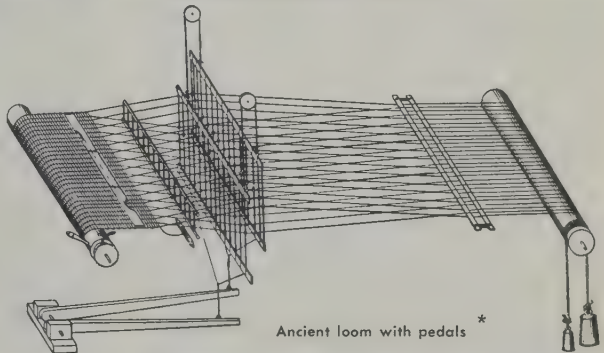
Swift and Company

First practical refrigerator car, 1875

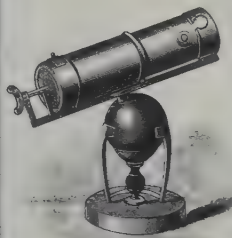


Ingersoll-Rand Company

Compressed air rock drill, 1871



Ancient loom with pedals *



Culver Service

First reflecting telescope, 1668



Bettmann Archive

Watt's condensing steam engine, 1765

were modified, but the primary features of the new process were established when the 42-line Bible was printed (c. 1453).

The addition of the flyer to the spinning wheel was an important invention. It doubled the output of the spinner, and opened the way to the application of power to spinning. A dated picture of 1480 shows the flyer as a device already in use. The possibility of applying power was perceived by Leonardo da Vinci, but, although his machine provided for many of the motions, one essential element in the machine was still wanting. The use of rolls was introduced by John Wyatt and Lewis Paul in 1733; there were still defects, however, which were not overcome until Richard Arkwright made small, but vital, improvements (1769).

Heavy-duty screws were more extensively used in the 15th century, and Leonardo da Vinci perceived the possibility of using long lead screws to operate machine tools. One of the notable applications of this principle was a machine to cut long screws of varying pitch. This device foreshadowed the machine tools of the 19th century, but the wooden lathes were not sturdy enough to produce accurate work. Much of Leonardo's work remained in this conceptual stage, but it was nevertheless of great importance. A number of his inventions are cited in the list that follows under the general date 1496, as the mechanical drawings are not dated, nor arranged in chronological sequence.

Rise of Modern Technology.—Benvenuto Cellini developed a screw press for stamping medals and coins (1512). This invention laid the foundations for the development of die stamping, first for coinage in France, England and Spain, and later for much flat work in gold and silver. Small rolling mills were used in preparing gold and silver for coinage. Improvements in pump construction in the 16th century made it possible to use the vacuum pump effectively. Metal fittings were used for critical features of the pump, and they began to displace force pumps. Analysis of the problems of the pump led to the discovery and measurement of atmospheric pressure. Otto von Guericke demonstrated the magnitude of these forces, and an atmospheric engine was invented by Thomas Savary and Thomas Newcomen. Watt's analysis of the performance of these engines led directly to the invention of the condensing steam engine. Modern power engineering thus rests directly upon a chain of inventions initiated by the development of pumps in the mines of Germany in the time of Agricola (1494?–1555).

The history of lathes and tool-making machinery runs parallel to the history of power machinery. Pattern turning lathes with a lead screw drive and a slide rest were invented for turning wood and ivory. In the clock and watch trades lathes were developed capable of working the nonferrous metals with accuracy. The invention of the pendulum made it essential to improve the escapement, and study of the behavior of the teeth of the escapement wheels led to a full mathematical analysis of gear teeth. John Wilkinson's boring engine, Henry Maudslay's lathe, Marc Brunel's block-making machinery, and Eli Whitney's system of interchangeable-part manufacture were the culmination of 250 years of progress in light engineering. The great tool makers of the early 19th century did accurate work in iron and steel that had been done earlier

in wood, ivory, and the nonferrous metals.

As we move into the 19th century, the scope of inventive effort can be most effectively appreciated if we deal with broad divisions of technology rather than with specific items. The individual inventions listed below will give the more important steps in the historical sequences. Power engineering was addressed to the task of developing a comprehensive set of prime movers using different sources of energy, and offering a variety of characteristics as to size and rate of revolution. In 1832, Benoit Fourneyron (1802–1867) invented the hydraulic turbine, which made it possible to use water power efficiently under an extraordinary range of conditions. The general principle admitted many variations in detail so that many alternative types of turbines were developed.

In steam engineering, the noncondensing engine was developed by Oliver Evans and Richard Trevithick. It found a wide range of uses, notably as the locomotive. Condensing engines were developed on the compound principle, with double and triple expansion. These types proved to be essential to marine use. Finally, steam turbines were invented by Carl de Laval (1882) and Sir Charles Parsons (1884); the differences in their characteristics were important as they were adapted to different uses. The whole array now provides for every need from running a cream separator to the generating equipment of a 100,000 kw central electric station. The internal combustion engines have been adapted to gas, gasoline, or oil as fuel, and also offer a wide range of sizes and types.

After a long period of modest development from the time of Benjamin Franklin to that of Thomas Edison, electricity finally became a basic form of energy. The application of electricity to the telegraph and telephone left electricity well below the level of major power engineering. The development of the dynamo and the motor opened up new potentialities, which were modestly exploited in small-arc lighting systems. With the invention of the carbon lamp (1878), the development of the central station (1882), and the successful establishment of electric traction (1888), electricity entered the field of primary power engineering. Large hydraulic turbines and the steam turbines made concentration of generating capacity highly advantageous, so that, as early as 1912, the importance of interconnected networks was perceived. After World War I large regional electrical networks began to appear in Europe and in the United States. Generalization in the production and distribution of power was largely complete in these areas by 1950. This marks the completion of a major stage in power engineering.

The importance of electrical developments in the power and light fields attracted so much attention that the development of other electrical apparatus received less notice than it deserved. The use of electricity in the fields of communication and observation seemed to be of secondary importance for the growth of the economy. This was, however, a complete misjudgment of the significance of the progress of the electrical sciences. The discovery and control of electromagnetic waves, the analysis of the cathode rays, and the comprehensive revision of the concept of the atom resulted in the most extensive development of pure science and technology that had occurred since the Renaissance.

The properties of electromagnetic waves were analyzed theoretically by James Clerk Maxwell in 1867, and the waves themselves were produced and studied by Heinrich Rudolph Hertz in 1887. Adequate techniques for general communication by wireless were achieved by Guglielmo Marconi in 1895, and a decade later great improvements in sending and receiving by the use of vacuum tubes made telephonic communication possible. The vacuum tube, as a control device, was developed from work initiated by Thomas Edison in 1885. In studying the blackening in the incandescent lamps, he inferred that carbon particles were projected in straight lines from the negative leg of the carbon filament. To prevent deposition of carbon on the bulb, he placed a metal plate in the bulb connected with the positive side of the direct current supplying the lamp. This prevented blackening, but he also observed that a current flowed across the vacuous space in the bulb. He was aware of the importance of this phenomenon as a means of regulating electrical apparatus, and he took out a patent, Oct. 21, 1884. The valve makes it possible to amplify energy at low levels into energy at high levels, so that massive apparatus can be controlled by initially weak currents or signals.

The earliest applications of the vacuum tube were in radio reception. In 1904, John Ambrose Fleming produced an incandescent lamp receiver based on studies of the Edison effect. Practical transmission and reception by this technique began with Lee de Forest's lamps of 1906 and 1907, to which a third grid had been added. Structural improvements, notably by Edwin Howard Armstrong in 1912 and 1913, established the vacuum tube firmly in the radio industry. The great extensions in the use of electronic devices in recent years received their initial impulse from the development of electronically controlled computing machines during World War II. The history of these machines is not closely associated with the mechanical computing machines of the earlier period. The simpler adding machines, beginning with Blaise Pascal in 1642, were adaptations of clockwork that had little significance for the future. The ambitious project of Charles Babbage (1823-1833) for the computation of logarithms showed clearly the limitations of purely mechanical principles. The geared wheels required more energy than could be practically supplied to the machine, and the rate of operation was too slow. The technique of supplying information by means of punched cards was, however, of early origin. The immediate source of this technique was the tabulating machine developed by H. Hollerith in 1885. His system was suggested by the use of cards in the Jacquard pattern weaving loom. The card was first used by M. Falcon in a rudimentary loom in 1736. It was fully perfected by Joseph Marie Jacquard in 1801. The developed electronic machines use magnetic tape as the ultimate means of giving directions to the machine, but the punched cards remain as an intermediate stage in the setting of problems for the machine.

The electronic computing machines fall into two general types: the digital computers, and the differential analyzers. The first type is capable of handling the problems of industrial control or office work. The differential analyzers are essential for certain kinds of scientific problems, and would supplement the simpler machines in some commercial work. The application of power

in the industrial field had long since prepared most of the mechanical appliances for the more extensive controls made possible by the electronic technique, but, with automation, it was possible to move from one train of mechanism to another without the intervention of an operator. For the control of processing, photoelectric cells or radioactive isotopes are used. It is, thus, possible to maintain more accurate conformity to standards than would be achievable by earlier methods of sample inspection.

The analysis of atomic structure has opened new vistas in science and technology. Since the Geneva conference on the peaceful uses of atomic energy, much progress has been made. With the achievement of "breeding" in 1953, the development of atomic energy for commercial use became practical. The British reactor at Calder Hall began to turn energy into the power system in 1956, and in that year reactors were under construction in the United States, Europe, and Soviet Russia.

New Environment of the Inventor.—The development of large research organizations has changed the environment of the inventor. Some writers have presumed that the essential characteristics of inventive work have been changed. There seems to be less inspiration, and, as Edison once said, more perspiration. However, invention has not become a laboratory process in the sense of being achievable at will. The essential features of such group work are almost a century old. Sir Henry Bessemer, at an early age, decided to become a professional inventor. It was to be a career. With less deliberation, perhaps, Edison found that his electrical inventions would use all his time, so with the receipts from the printing telegraph he established the laboratory at Menlo Park. The work on the incandescent lamp was done here under conditions that differ only in degree from those created by the research enterprises during World War II for the development of the work on radar and atomic fission.

The distinctive feature of these achievements is the organized, step-by-step development of the implications of a single phenomenon, such as the echo of radar waves or the spontaneous fission of uranium. Under modern conditions an organized effort results within a short time in a sequence of inventions comparable to the historical sequence from Torricelli's measurement of atmospheric pressure in 1644 to the invention of the steam turbines by de Laval and Parsons in 1882 and 1884. Work begins with an accumulation of observations, and at this stage much is done that hardly rises to the level of inventive activity, though the effort to make new kinds of observations requires the invention of scientific apparatus. The study of the atmosphere resulted almost at once in the invention of the barometer and the thermometer. In this early period, engineering skills were not mature enough to make it possible to condense the process of invention in time.

Basic scientific work in nuclear physics preceded the establishment of the Manhattan Project (q.v.), but the underlying work was done in laboratories and involved the invention of new apparatus. The spontaneous fission of uranium was known, and the analysis of the phenomena of fission was far advanced. The possibility of producing energy for commercial use was recognized, but the exploration of that potentiality was de-

liberately postponed. All three preferred approaches to the bomb were utilized. Each step in the highly concentrated work of the Manhattan Project can be matched in the history of the steam engine. It is not easy to see how the atomic program could have developed without the financial support of the government on a large scale, but this provision of funds does not affect the character or the quality of the inventive process. The complete achievement is the result of drawing together a great number of individual items resting on highly original acts of insight. If the records are complete, all the individual steps and personalities can be identified. The group effort concentrated in a short period of time does not

differ in essentials from a diffused effort over a long period.

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LIST OF PRINCIPAL INVENTIONS AND DISCOVERIES

Date	Invention or discovery	Inventor	Nationality	Date	Invention or discovery	Inventor	Nationality
c. 3400 B.C.	Bow drill	not known	Egyptian	1593	Thermometer	Galileo Galilei	Italian
c. 3000 B.C.	Potter's wheel	not known	Egyptian	1609	Telescope (refracting)	Galileo Galilei	Italian
c. 1500 B.C.	Water clock	not known	Egyptian	1620	Screw printing press	William J. Blaeu	Dutch
Before 500 B.C.	The groma (surveying star)	not known	Egyptian	1621	Ribbon loom	not known	Dutch
c. 400 B.C.	Catapult and cross-bow	not known	Greek	1630	Use of steam	David Ramsay	English
c. 275 B.C.	Water organ	Ctesibius	Greek	1630	Kepler's astronomical telescope	Constructed by Christopher Schriener	German
c. 250 B.C.	Force pump	Philo of Byzantium	Greek	1636	Micrometer	William Gascoigne	English
c. 250 B.C.	Cross staff	Archimedes	Greek	c. 1640	Mezzotint engraving	Ludwig von Siegen	German
c. 250 B.C.	Chain of pots	Philo of Byzantium	Greek	1642	Adding machine	Blaise Pascal	French
c. 250 B.C.	Undershot water wheel	Philo of Byzantium	Greek	1643	Barometer	Evangelista Torricelli	Italian
c. 250 B.C.	Water screw	Archimedes	Greek	1654	Air pump	Otto von Guericke	German
c. 250 B.C.	Beam press, wine or olive	not known	Greek	1656	Pendulum clock	Christian Huygens	Dutch
c. 161 B.C.	Quadrant	Hipparchus	Greek	1668	Telescope (reflecting)	Sir Isaac Newton	English
c. 150 B.C.	Noria (water wheel)	not known	Egyptian	1669	Phosphorus	Hennig Brand (Brandt)	German
Before 100 B.C.	Quilling wheel	not known	Syrian?	1671	Multiplying machine	G. W. von Leibnitz	German
Before 100 B.C.	Draw loom	not known	Chinese	1681	Machine for generating electricity	Otto von Guericke	German
c. 85 B.C.	Horizontal water wheel	not known	Greek	1690	First steam engine with a piston	Denis Papin	French
c. 50 B.C.	Water wheel with gears	Vitruvius	Roman	1696	Discovery of difference between electric conductors and insulators	Stephen Gray	English
c. 25 B.C.	Screw presses	Vitruvius	Roman	1698	First practical application of steam power for mechanical purpose	Thomas Savery	English
c. 65 A.D.	Dioptra (surveyor's angular measure)	Hero of Alexandria	Roman	1708	First to produce electric spark	Dr. J. Wall	English
c. 65	Hodometer (cyclometer)	Hero of Alexandria	Roman	1709	Coke-burning iron furnace	Abraham Darby	English
c. 150	Loom with four or more heddles	not known	Syrian	1709-11	Piano and hammer action for piano	Bartolomeo Cristofori	Italian
c. 800	Windmills	not known	Persian	1712	First atmospheric pressure steam engine	Thomas Newcomen	English
1272	Silk doubling	not known	Italian	1714	Typewriter	Henry Mill	English
1335	Mechanical clock	not known	German	1714	First use of mercury in thermometer	G. D. Fahrenheit	German
1450	Adjustable type mold	Johann Gutenberg	German	1717	Diving bell	Edmund Halley	English
Before 1480	Spindle and flyer	not known	German	1718	Electrometer (pith-ball)	John Cantor	English
c. 1496	Power-driven spindle and flyer	Leonardo da Vinci	Italian	1725	Stereotyping	William Ged	Scottish
c. 1496	Die and collar, for coinage	Leonardo da Vinci	Italian	1726	Gridiron pendulum	John Harrison	English
c. 1496	Punches for metal	Leonardo da Vinci	Italian	1727	Electrical plate glass machine	Martin de Planta	French
c. 1496	Rolling mill	Leonardo da Vinci	Italian	1729	First electric signal sent along a wire	Stephen Gray	English
c. 1496	Gilling mill	Leonardo da Vinci	Italian	1733	Flying shuttle	John Kay	English
c. 1496	Screw-cutting lathe with gears	Leonardo da Vinci	Italian	1733-39	First to discover that electricity is of two kinds—positive and negative	Charles de Cisternay Du Fay	French
c. 1496	File cutter	Leonardo da Vinci	Italian	1740	Steel crucible process	Robert Huntsmand	English
c. 1496	Antifriction roller bearings	Leonardo da Vinci	Italian	1746	Leyden jar	John Bevis	English
1560-1603	Electricity and magnetism	William Gilbert	English	1749	Marine chronometer	John Harrison	English
c. 1581	Isochronism of the pendulum	Galileo Galilei	Italian	1752	Lightning rod experiments	Benjamin Franklin	American
1589	Knitting machine	William Lee	English	1754	Helium	John Dollond	English
1590	Compound microscope	Zacharias Jansen	Dutch				

LIST OF PRINCIPAL INVENTIONS AND DISCOVERIES—Continued

Date	Invention or discovery	Inventor	Nationality	Date	Invention or discovery	Inventor	Nationality
1756	Hydraulic cement	John Smeaton	English	1803-04	Discovery of osmium and iridium	Smithson Tennant	English
1758	Achromatic lens	John Dollond	English	1804	Rocket	Sir William Congreve	English
1760	Lightning conductor	Benjamin Franklin	American	1804	Screw propeller	John C. Stevens	American
1770	First self-propelled vehicle (3-wheeled steamer—4 riders)	Joseph Cugnot	French	1804	Steam locomotive on rails	Richard Trevithick	English
1771	Larger model called "Cugnot's truck"	Joseph Cugnot	French	1804-05	Canning of food	Nicolas Appert	French
1764	Spinning jenny	James Hargreaves	English	1805	Life preserver	John Edwards	English
1765	Steam engine (condensing)	James Watt	Scottish	1805	Electroplating process	Luigi Brugnatelli	Italian
1769	Throttle spinning machine	Richard Arkwright	English	1807	Wood mortising machine	Marc I. Brunel	French
1769	Steam engine	James Watt	Scottish	1807	Improved paper-making machine	Henry and Sealy Fourdrinier with Bryan Donkin	English
1776	Submarine boat ("Bushnell's turtle")	David Bushnell	American	1807	Gas meter (wet)	S. Clegg	English
1777	Circular wood saw	Samuel Miller	English	1807	The <i>Clermont</i> , steam-boat	Robert Fulton	American
1779	Spinning machine-mule jenny	Samuel Compton	English	1808-10	Polarization of light	Etienne Louis Malus	French
1779	Discovery of elements uranium, titanium, zirconium	Martin Heinrich Klaproth	German	1808	Barium, strontium and calcium metallic magnesium first prepared	Sir Humphry Davy	English
1780	Steel pen	Samuel Harrison	English	1808	Voltaic arc	Sir Humphry Davy	English
1780	Bifocal lens	Benjamin Franklin	American	1808	First steamboat to make a trip to sea (<i>Phoenix</i>)	John Stevens	American
1781	Compound steam engine	Jonathan C. Hornblower	English	1809	Law of combining volumes	J. L. Gay-Lussac	French
1781	Double-acting steam engine	James Watt	Scottish	1810-11	Breech-loading rifle	John M. Hall	American
1783	Gas balloon	Joseph E. and Etienne M. Montgolfier	French	1810	Homeopathy introduced	Samuel Hahnemann	German
1783-84	Puddling iron furnace	Henry Cort	English	1811	Printing press (steam)	Friedrich König	German
1784	Plow, with cast iron mold board, and wrought and cast iron shares	James Small	Scottish	1812	Storage battery	J. B. Ritter	German
1784	Embossed printing for the blind	Valentin Haüy	French	1814	Percussion cap	Joshua Shaw	American
c. 1784	Shrapnel shell	Henry Shrapnel	English	1815	Miner's safety lamp	Sir Humphry Davy	English
1785-88	First true water-tube boiler	James Rumsey	American	1815-19	Stethoscope	Rene T. H. Laennec	French
1785	Power loom	Edmund Cartwright	English	1816	Knitting machine, circular	Marc I. Brunel	French
1785	Parachute	François Blanchard	French	1816	Kaleidoscope	Sir David Brewster	English
1786	Threshing machine	Andrew Meikle	Scottish	1816	"Columbian" printing press	George E. Clymer	American
1786	Nailmaking machine	Ezekiel Reed	American	1817	Paper machine (cylinder)	Thomas Gilpin	American
1786-87	First steamboat trial in U.S.	John Fitch	American	1819	Cast iron plow (modern shape)	Jethro Wood	American
1788	Drum threshing machine	Andrew Meikle	Scottish	1819	Galvanometer	J. S. Schweigger	German
1789	First motor-driven road vehicle in America	Oliver Evans	American	1819	Electromagnetism discovered	Henry C. Oersted	German
1790	Machine for printing on linen	William Nicholson	English	1819	Stethoscope	René Laennec	French
1790	Machine for stitching; forerunner of sewing machine	Thomas Saint	English	1820	Quinine	P. J. Pelletier and J. B. Caventou	French
c. 1790	Machine for cutting nails	Jacob Perkins	American	1820	Hygrometer	John F. Daniell	English
1790-91	Soda from salt	Nicolas LeBlanc	French	1820	Calculating machine	Charles Babbage	English
1792	Gas used as an illuminant	William Murdoch	Scottish-American	1821	Theory of electrodynamics	André Ampère	French
1793-94	Cotton gin	Eli Whitney	American	1822	Multicolor printing	Peter Force	American
1795	Hydraulic press	Joseph Bramah	English	1822	Discovery of thermoelectricity	T. J. Seebeck	German
1796	Lithography	Aloys Senefelder	Bohemian	1822	Power platen printing press	Daniel Treadwell	American
1797	Cast-iron plow	Charles Newbold	English	1822	Conversion of electric current into mechanical motion	Michael Faraday	English
1797	Carding machine (improved)	Amos Whittemore	American	1822	Early type-setting machine (automatic)	William Church	American
1800	Electric battery	Alessandro Volta	Italian	1823	Liquefaction and solidification of gas	Michael Faraday	English
1800	High pressure steam engine	Richard Trevithick	English	1823	Silicon	J. J. Berzelius	Swedish
1800	Discovered exhilarating effect of nitrous oxide when inhaled (anaesthesia)	Oliver Evans (independently)	American	1823	Shield tunneling	Marc Brunel	English
1801	Jacquard machine for figured-weaving	Sir Humphry Davy	English	1824	Portland cement	Joseph Aspdin	English
1801	Jacquard machine for figured-weaving	Joseph Marie Jacquard	French	c. 1824	Proved law to which all heat engines are subject	Nicholas Leonard S' Carnot	French
1802	Photographic experiments	Thomas Wedgwood and Sir Humphry Davy	English	1824	Pinmaking machine	L. W. Wright	American
1802	Photographic experiments	Thomas Wedgwood and Sir Humphry Davy	English	1825	First successful steam locomotive	George Stephenson	English
1802	Application of twin screw propellers	William Symmington	English	1825	Electromagnet	William Sturgeon	English
				1826	Electrical spur wheel	Peter Barlow	English
				1827	Muzzle-loading needle gun	Johann N. von Dreyse	German
				1827	Law of electrical resistance	George S. Ohm	German

LIST OF PRINCIPAL INVENTIONS AND DISCOVERIES—Continued

Date	Invention or discovery	Inventor	Nationality	Date	Invention or discovery	Inventor	Nationality
1827	Law of galvanic circuits	George S. Ohm	German	1846	Sewing machine (improved)	Elias Howe	American
1827	Differential for road vehicles	Onésiphore Pecqueur	French	1846	Guncotton	Christian F. Schönbein	German
1827	Isolation of aluminum	Friedrich Wöhler	German	1847	Regenerative steam engine	Sir William Siemens	German-English
1827	Friction matches	John Walker	English	1847	Rotary printing press	Richard H. Hoe	American
1827	Turbine (hydraulic)	Benoit Fourneyron	French	c. 1847	Nitroglycerine	Ascanio Sobrero	Italian
1828	Prism for polarized light	William Nicol	English	1847	Chloroform in surgery	Sir James Y. Simpson	Scottish
1828	Hot-air blast for iron furnaces	J. B. Neilson	Scottish	1848	Current generated by a dynamo used to excite its magnet	Jacob Brett	English
1829	Thermoelectric needle for determining internal bodily temperatures	Antoine C. Becquerel	French	1849	Corliss engine	George H. Corliss	American
1829	First American type-writing machine	W. A. Burt	American	1849	Turbine hydraulic	James B. Francis	American
1829	Braille printing	Louis Braille	French	1849	First factory-made watches	Aaron L. Dennison	American
1830	Sewing machine	Barthelémy Thimmonier	French	1850	Mercerized cotton	John Mercer	English
1831	Flanged rail	Robert L. Stevens	American	1850-51	Electric locomotive	Charles G. Page	American
1831	Electricity generated from magnetism	Michael Faraday	English	1851	Gordon printing press	George P. Gordon	American
1831	Chloroform	Joseph Henry	Scottish	1851	Refrigerating machine	John Gorrie	American
1832	Hydraulic turbine	Samuel Guthrie	French	1851	Ophthalmoscope	Hermann L. F. von Helmholtz	German
1832	First conception of electric telegraph	B. Fourneyron	French	1851	Photography (collodion process)	Scott Archer	English
1833	Adoption of steam whistle for locomotives	Samuel F. B. Morse	American	1852	Regulated screen for half-tone photographic printing	William H. F. Talbot	English
1833	Gas meter (dry)	George Stephenson	English	1852	Gyroscope	Jean B. Léon Foucault	French
1833-34	Reaper	James Bogardus	American	1852	Airship	Henri Giffard	French
1834	Discovery of aniline in coal tar	Cyrus H. McCormick and Obed Hussey	American	1853	Condensed milk	Gail Borden	American
1834	Ice machine (compressor system)	Friedlieb F. Runge	German	1853	Laws of magnetoelectric induction	Michael Faraday	English
1835	Revolver	Jacob Perkins	American	1853	Duplex telegraph	Wilhelm I. Gintl	Austrian
1836	First working model of telegraph	Samuel Colt	American	1853	Laws of electrostatics	Michael Faraday	English
1836	Electric battery (Daniell's cell)	Samuel F. B. Morse	American	1853	Electrolysis	Michael Faraday	English
1836	Phosphorus matches manufactured in United States	John F. Daniell	English	1854	Four-motion feed for sewing machines	Allen B. Wilson	American
1836-41	Introduction of screw propeller	Alonzo Dwight Phillips	American	1854	Magazine firearm	Horace Smith and Daniel Baird Wesson	American
1837	Electric telegraph for sending messages patented	John Ericsson	Swedish	1854	Dynamo-electric machine (drum-wound armature)	Werner von Siemens	German
1837	Electromagnet used in dynamo	Sir Charles Wheatstone	English	1855	Safety matches	J. E. Lundstrom	Swedish
1837	First stereoscope	Charles G. Page	American	1855	Rubber dental plate	Charles Good-year, Jr.	American
1838	Steam hammer	Sir Charles Wheatstone	English	1855	Gas burner (Bunsen burner)	Robert Wilhelm Bunsen	German
1838	Babbitt metal	James Nasmyth	Scottish	1856	Aniline dyes	Sir William H. Perkin	English
1839	Photography (Daguerreotype)	Isaac Babbitt	American	1856	Printing machine for the blind	Alfred E. Beach	American
1839	Ozone	Joseph N. Niepe, Louis Daguerre	French	1856	Furnace (improved regenerative)	Sir William Siemens	German-English
1839	First boat electrically propelled	Christian F. Schönbein	German	1856-57	Bessemer steel	William Kelly	American
1840	Photo-prints from paper negatives	M. H. Jacobi	German	1857	Electric fire-alarm telegraph	Sir Henry Bessemer	English
1840	Photographic portraits (Daguerreotype process)	William Henry Fox Talbot	English	1857	Shoe sewing machine	William F. Channing and Moses G. Farmer	American
1840-44	Telegraph perfected. First message sent 1844	Samuel F. B. Morse	American	1857	Refrigerator	Lyman R. Blake for George McKay	American
1842	Ether as an anæsthetic	Crawford W. Long	American	1858	Feed injector for boilers	Ferdinand P. E. Carré	French
1843	Typewriting machine patented	Charles Thurber	American	1858	Cable car	Henri Giffard	French
1844	Vulcanized rubber	Charles Good-year	American	1859	"Harrison steam boiler"	E. A. Gardner	American
1844	The use of nitrous oxide gas as an anæsthetic	Joseph Harrison	American	1859-60	Prism spectroscope	Robert W. Siemens	German
1844	The electric arc light (gas retort carbon in a vacuum)	Dr. Horace Wells	American	1859-60	Gas engine	Gustav R. Kirchhoff	German
1845	Automatic adjustment of electric arc light carbons	J. B. Foucault	French	1860	Cylinder lock	Robert W. Bunsen	German
1845	Pneumatic tire	J. J. E. Lenoir	French	1860	Linoleum	Linus Yale	American
		Thomas Wright	English	1860	Storage or secondary battery	Frederick Walton	English
		Robert W. Thompson	English	1860	Electric lamp (carbon filament)	Gaston Planté	English
				1860	Electric lamp (carbon filament)	Joseph W. Swan	English

LIST OF PRINCIPAL INVENTIONS AND DISCOVERIES—Continued

Date	Invention or discovery	Inventor	Nationality	Date	Invention or discovery	Inventor	Nationality
1861	First described publicly an electrical telephone	Johann Philipp Reis	German	1879	Incandescent light	Thomas A. Edison Sir Joseph Swan (independ- ently)	American English
1861	Passenger elevator (steam)	Elisha G. Otis	American	1880	Typhoid bacillus isolated	Karl J. Eberth and Robert Koch	German
1861	Motion picture projector	Coleman Sellers	American	1880	Evaporated milk	John B. Meyenberg	American
1861	Electric furnace	Sir William Siemens	German-English	1881	Color photography	Frederick E. Ives	American
1862	Revolving turret for floating battery	Theodore Timby	American	1882	Tuberculosis bacillus isolated	Robert Koch	German
c. 1862	Smokeless powder	Johann F. E. Schultze	Prussian	1882	Hydrophobia bacillus isolated	Louis Pasteur	French
1862	Gatling gun	Richard J. Gatling	American	1882	Steam turbine (impulse type)	Carl G. P. de Laval	French
1862-63	Sleeping car	T. T. Woodruff	American	1882	Glanders bacillus isolated	F. A. J. Löffler	German
1863	Railway block signals	Ashtel Welch	American	1883	Cholera bacillus isolated	Robert Koch	German
1863	Soda (from salt, ammonia and CO ₂)	Ernest Solvay	Belgian	1884	Diphtheria bacillus isolated	Edwin Klebs F. A. J. Löffler	German German
1864	Sleeping car (with folding upper berth)	George M. Pullman	American	1884	Bicycle (modern type)	Karl Benz James Starley	German English
1865	Bicycle	Pierre Lallemand	French	1884	Bacillus of tetanus	Arthur Nicolaier	German
1866	Dynamite	Alfred B. Nobel	Swedish	1884	Fountain pen perfected	Lewis E. Waterman	American
1866	Open-hearth steel process	Sir William Siemens	German-English	1884	Antipyrine	Ludwig Knorr	American
1866	Torpedo (self-propelled)	Robert Whitehead	English	1884	Photographic roll films	William H. Walker	American
1866	The Atlantic cable laid	Cyrus W. Field	American	1884	Linotype	Ottmar Mergenthaler	German-American
1867	Dynamo electric machine	Sir William Siemens	German-English	1884	Artificial silk	Count Hilaire B. de Chardonnet	French
1867	Dynamo electric machine	Sir Charles Wheatstone Henry Wilde (separately)	English	1884	Steam turbine (reaction type)	Sir Charles A. Parsons	English
1867	Reinforced concrete	Joseph Monier	French	1884	Manganese steel	Robert Hadfield	English
1867-68	First practical type-writing machine	Christopher L. Sholes Carlos Glidden Samuel W. Soule	American American American	1885	Tabulating machine	H. Hollerith	American
1868	Automatic car coupler	Eli Hamilton Janney	American	1885	Bordeaux mixture	Alexis Millardet	French
1869	Antiseptic surgery	Sir Joseph Lister	English	1885	Maxim recoil operated machine gun	Sir Hiram S. Maxim	American
1869	Railway air brake	George Westinghouse, Jr.	American	1885	Automobile engine (2-stroke)	Karl Benz	German
1870	Celluloid	John Wesley and Isaiah Hyatt	American	1885	Graphophone and dictaphone	Charles S. Tainter	American
1870	Mowing machine with differential gear	Rudolf Eickemeyer	American	1885	Gas mantle	Carl von Welsbach	Austrian
1871	Compressed air rock drill	S. Ingersoll	American	1886	Half-tone engraving process	Frederick Eugene Ives	American
1871	The Goodyear welt shoe-sewing machine	Charles Goodyear	American	1887	Daimler engine for automobile	Gottlieb Daimler	German
1871	Photographic gelatine bromide emulsion	R. L. Maddox	English	1887	Gramophone	Émile Berliner	American
1872	Dynamo-electric machine	Zenobe T. Gramme	Belgian	1887	Photography, roll-film	Hannibal Goodwin	American
1873	Initial steps in color photography	Hermann W. Vogel	German	1887	Monotype	Talbot Lanston	American
1873	Theory that light is an electrical phenomenon	James C. Maxwell	English	1887	Hertzian waves	Heinrich Hertz	German
1873	Telegraph (quadruplex system)	Thomas A. Edison	American	1888	Recording adding machine	William Burroughs	American
1875	Electric searchlight	Henry Wilde	English	1888	Pneumatic tire	John B. Dunlop	Irish
1875	Railway refrigerator car	G. F. Swift Co.	American	1888	Trolley car (practical system)	Frank J. Sprague	American
1876	First satisfactory web perfecting printing press	Andrew Campbell	American	1888	"Kodak"	George Eastman	American
1876	Telephone	Alexander Graham Bell	American	1888	Process for hardening the surface of steel ("Harvey Process")	Hayward A. Harvey	American
1876	Four-cycle gas engine (Otto motor)	Nikolaus August Otto	German	1888	System of polyphase electric current	Nikola Tesla	American
1876	Electric candle	Paul Jablockov	Russian	1892	Acetylene gas	Thomas L. Wilson	American
1877	Glider	Otto Lilienthal	German	1892	Diesel engine	Rudolf Diesel	German
1877	Loose-contact telephone transmitter	Émile Berliner	American	1892	Wireglass	Frank Shuman	American
1877	Phonograph	Thomas A. Edison	American	1892	Viscose	Charles Frederick Cross E. J. Bevan	English
1878	Automatic grain binder	John F. Appleby	American	1892	Electric motor (alternating current)	Nikola Tesla	American
1878	Electric arc lighting	Charles F. Brush	American	1892	Vacuum bottle	James Dewar	English
1879	Cathode-ray tube	Sir William Crookes	English	1892	Coherer (for detecting "wireless" waves)	E. Branly	French
1879	Cash register	James Ritty	American	1893	Motion pictures (kinetoscope)	Thomas A. Edison	American
				1894	Motion pictures (phantascope)	Charles F. Jenkins	American
				1894	Color photography (ruled screen process)	John Joly	Irish
				1895	Principle of the modern motion picture projector	Thomas Armat	American

LIST OF PRINCIPAL INVENTIONS AND DISCOVERIES—Continued

Date	Invention or discovery	Inventor	Nationality	Date	Invention or discovery	Inventor	Nationality
1895	X-rays	Wilhelm K. von Roentgen	German	1912	Supersonic wave detector of submarine objects conceived	O. W. Richardson	English
1895	Photoelectric cells	Julius Elster	German	1913	Electric light (gas filled tungsten)	Irving Langmuir	American
1895	Gasoline automobile in United States	Hens F. Geitel	German	1913	Radio receiver (heterodyne)	Reginald A. Fessenden	Canadian
1895	Wireless telegraphy	George Baldwin Selden	American	1913	Electron tube improvements	Irving Langmuir	American
1896	Foundation laid of science of radio-activity	Guglielmo Marconi	Italian	1913	Radio receiver (cascade tuning)	Ernst F. W. Alexanderson	Swedish-American
1896	Phenomena known as Zeeman effect	Henri Becquerel	French	1913	Talking motion pictures	Thomas A. Edison	American
1897	Thermit process	Pieter Zeeman	Dutch	1913	Geiger counter perfected	Hans Geiger	German (England)
1897	Nernst lamp	Hendrik A. Lorentz	Dutch	1913	Ramjet engine	René Lorin	French
1898	Submarine boat (first successful)	Hans Goldschmidt	German	1914	Liquefaction of coal (for producing gasoline)	Friedrich Bergius	German
1898	Photographic paper, sensitized	Walther Nernst	German	1914?	Radio transmitter (triode modulation)	Ernst F. W. Alexanderson	Swedish-American
1898	Radium discovered	John P. Holland	American	1914	Tank (military)	Gen. Ernest D. Swinton	English
1899	High-speed steels	George Baeke-land	American	1915?	Radio tube oscillator	Lee De Forest	American
1900	Quantum theory	Frederick W. Taylor	American	1916?	X-ray tube	William D. Coolidge	American
1900	Pupin coil	Maunsel White	German	1917	Submarine detector	Max Mason	American
1900	Cellophane	Max Planck	German	1918	Protactinium discovered	Lise Meitner	Austrian
1900	Caterpillar tractor	Michael I. Pupin	American	1918	Ultra-sonic wave detector of submarine objects	Otto Hahn	German
1900-01	Airship (rigid type)	J. E. Brandenberger	French	1919	Artificial disintegration of light atoms	Admiralty Experiment station	English
1901	Automobile mower	Benjamin Holt	American	1920?	Quantum theory	E. Rutherford	English
1901	Patent for synchronizing a motion picture with sound track	Ferdinand von Zeppelin	German	1920?	Wilson cloud chamber	Niels Bohr	Danish
1902	Discovery of the spontaneous disintegration of atoms	Alberto Santos-Dumont	Brazilian	1921	Hit and miss synchronizer	Charles T. R. Wilson	Scottish
1902	Hydrogenation (catalytic)	Deering Harvest-er Co.	American	1922?	Insulin (isolation)	W. H. Shortt	English
1903?	Nickel storage battery	Léon E. Gaumont	French	1923	Arc tube	Sir Frederick G. Banting	Canadian
1903	Airplane	E. Rutherford	English	1923	Iconoscope	Charles H. Best	Canadian
1903-06	Gas turbine, type A	Paul Sabatier	French	1924	Perfect astronomical clock	Ernst F. W. Alexanderson	Swedish-American
1904	Electron tube (practical)	Thomas A. Edison	American	1925	Phototelegraphy	Vladimir Zworykin	Russian-American
1904	Photo transmission by wireless	Wright Brothers (Orville and Wilbur)	American	c. 1926	Compton effect (change in wave length of scattered X-ray)	W. H. Shortt	English
1904	Automatic acceleration of railway motors	René Armengaud and Charles Lemale	French	1926	First liquid-propelled rocket	John L. Baird	Scottish
1905	Gyroscopic compass	Sir John A. Fleming	English	1926	Rocket (first liquid fuel)	Charles F. Jenkins	American
1905-16	Theory of relativity	Arthur Korn	German	1927	Spectograph perfected	Bell Telephone Laboratories	American
1907	Three-electrode vacuum tube	George Westing-house	American	1928	Autogiro	Arthur H. Compton	American
1907	Plastic (Bakelite)	Elmer A. Sperry	American	1928	Electronic pickup tube (image dissector)	R. W. Goddard	American
1907	Color photography (Autochrome process)	Albert Einstein	German	1928	Penicillin	Robert H. Goddard	American
1908	Gas turbine, type K	Lee De Forest	American	1930?	Neoprene	F. W. Aston	English
1909?	Maxim silencer for firearms	Leo H. Baeke-land	American	1930	Reflecting telescope with correcting plate	Juan de la Cierva	Spanish
1910	Cosmic rays discovered	Auguste and Louis J. Lumière	French	1930?	Discovery of heavy hydrogen	Philo Farnsworth	American
1910?	Tungsten lamp	Karavodine	English	1931	Cyclotron	Sir Alexander Fleming	English
1911	Air conditioning	Hiram P. Maxim	American	1931	Sonic range finder for submarine objects perfected	Wallace H. Carothers	American
1911	Hydroplane	A. Gockel	Swiss	1932	Pulse jet engine	B. Schmidt	German
1911	Air-cooled gun	William D. Coolidge	American	1933?	Radio (wide-band frequency modulator)	Harold Urey	American
1911	Gas turbine, type H	Willis H. Carrier	American	1934?	Garand rifle	Ernest O. Lawrence	American
1911	Atomic nucleus analyzed	Glenn H. Curtiss	American	1934	Disintegration of uranium	Admiralty Experiment Station	English
1912	Flying boat (sea-plane)	Isaac N. Lewis	American	1935?	Kendall's compound E (forerunner of cortisone)	Paul Schmidt	German
1912	Optophone	Holtzwarth	German			Edwin H. Armstrong	American
1912	Vac. tube oscillator	E. Rutherford	English			John C. Garand	American
		Glenn H. Curtiss	American			Enrico Fermi	Italian ¹
		Edmund E. Fournier d'Albe	English			Edward C. Kendall	American
		Lee De Forest	American				

¹American citizen since 1945.

LIST OF PRINCIPAL INVENTIONS AND DISCOVERIES—*Continued*

Date	Invention or discovery	Inventor	Nationality	Date	Invention or discovery	Inventor	Nationality
1935	Radiolocator (radar)	Sir Robert A. W. Watt	Scottish	1941	Plutonium discovered	E. M. Macmillan	English
1935	Protosol (forerunner of sulfanilimide)	Gerhard Domagk	German	1942	First controlled chain reaction	E. Fermi	Italian ¹
1935	Cortisone	Edward C. Kendall and co-workers, Mayo Clinic	American	1942	Helical scanning radar	A. E. Hodgkin and P. T. Dee	English
1936	First pulse radars designed	Sir Robert A. W. Watt	Scottish	1943	Production of V-2 bombs begun	German government	German
		U.S. Army Signal Corps Laboratory	American	1943?	Streptomycin	Selman A. Waksman	American
		British National Physical Laboratory	English	1943?	Bacitracin	Balbina Johnson Frank L. Meloney	American
1936	Meson observed	Carl Anderson	American	1945	Atomic bomb	World-famous scientists under the direction of J. R. Oppenheimer	American
1937	Nylon	Wallace H. Carothers	American	1949	ACTH	Armour Research Laboratories	American
1937?	Jet propulsion	Frank Whittle	English	1949	Pilotless jet plane	Sperry Gyroscope Co.	American
1937?	Transuranium synthesized (element 93)	Enrico Fermi	Italian ¹	1951	Experimental breeder reactor completed	Atomic Energy Commission, Arco, Idaho	American
1938	Fission of uranium	Lise Meitner, Otto Hahn, Fritz Strassman	Austrian, German, German	1953	Uranium breeding achieved	Atomic Energy Commission, Arco, Idaho	American
1939?	Dynamo (electric machine modulator)	Ernst F. W. Alexanderson	Swedish-American	1956	Cryotron, a super-conductor tube	D. A. Buck	American
1939	Release of neutrons in fission of uranium shows chain reaction possible	F. Joliot-Curie, Hans H. Halban, and L. Kowarski	French	1956	Calder Hall reactor in operation	Atomic Energy Authority	English
1939	Analysis of atomic fission	Niels Bohr	Danish	1957	Image converter for telescopes	Carnegie Institute, Radio Corporation of America, and Farnsworth Electronics Co.	American
1939	Helicopter	Henry Focke, Igor-Sikorski	German, American	1957	Unnamed enzymes essential to photosynthesis identified	The Johns Hopkins University	American
1939-40	Radar rangefinder	Admiralty Signal Establishment	English	1957	First (man-made) satellites	USSR	Russian
1940?	Carried forward Sir Alexander Fleming's discovery of penicillin	Ernest B. Chain	English				
1940	Magnetron, 10cm radar waves	Sir Howard W. Florey, J. T. Randall and H. A. H. Boot	English				

¹American citizen since 1945.

INVENTORY, in'-vën-tō-rī, an itemized list of goods, chattels, debts, credits, and sometimes real estate, usually with the corresponding actual or estimated value attached, made to fulfill legal requirements or as a routine business procedure. The "benefit of inventory" originated in Roman law, to protect an heir from liability for debts and claims beyond the value of the estate inherited. Today executors or administrators are required, as one of their first duties, to file an inventory of the property in their charge in order to secure it to the persons entitled to it. Guardians are also required to make inventories of estates held in trust for their wards, and bankrupts or insolvents have to file a list of their property, debts, and liabilities.

INVERCARGILL, in-vēr-kär'gil, city, New Zealand, on South Island. It is the capital of Southland County, in Otago Provincial District, on an inlet of Foveaux Strait, 110 miles southwest of Dunedin. Invercargill is the rail, trade, and commercial center of an agricultural and dairying area. Included among its manufacturing establishments are flour and wool mills, breweries, foundries, and timber works. Although it has a good harbor, most of the shipping occurs at nearby Bluff. It was settled in 1857. Pop. (1956 est.) 34,293.

INVERCHAPEL, in-vēr-chăp'ěl, 1st BARON (ARCHIBALD JOHN KERR CLARK KERR), British

diplomat: b. Lanarkshire, Scotland, March 17, 1882; d. Greenock, July 5, 1951. He entered the diplomatic service in 1906, and after four years in the Berlin embassy was transferred to Buenos Aires, Argentina, and a year later to Washington, D.C. In 1913 he was sent to Rome, and after the outbreak of World War I to Teheran, Persia (Iran), where by 1916 he was in charge of the legation's commercial affairs. At his own insistence he was allowed to enlist in the Scots Guards, and saw active fighting in World War I as a private. In 1919 he resumed his diplomatic career, serving successively as British minister to Guatemala (1925-1928), Chile (1928-1931), and Sweden (1931-1935), and then as ambassador to Iraq (1935-1938). In 1938 he was appointed ambassador to China, which was then engaged in war with Japan; his diplomatic talents were well displayed in the difficult task of reaffirming Britain's friendship for the former while at the same time not provoking war with the latter. He was sent to Moscow as ambassador in 1942 and remained there four years, participating in the Cairo, Teheran, Yalta, and Potsdam conferences as adviser to the British representatives. He went to Java on a special mission in January 1946, endeavoring to find a solution to the Netherlands-Indonesian dispute, and on his return to London was made a baron, taking the title of Lord Inverchapel of Loch Eck. From June 1946 until February 1948 he was ambassador to the United States.



Philip Gendreau

A 19th century castle rises above Inverness, on the river Ness.

INVERNESS, ĭn-vēr-nēs', town, Nova Scotia, Canada, in Inverness County, on the west coast of Cape Breton Island, 55 miles west of Sydney. Mining, lumbering, fishing, and agriculture are the chief industries of the area. There are fine bathing beaches, and hunting and fishing are popular in the Margaree district. Gaelic is spoken extensively by the descendants of the original Scottish settlers of the region. The town, on a branch of the Canadian National Railway, is picturesquely situated on the shore of the Gulf of St. Lawrence. There are coal mines in the vicinity, and it is a coal shipping port. A deep-sea fishery operates from the harbor. The town was incorporated in 1904. Pop. 2,109.

INVERNESS, burgh, Scotland, the county seat of Inverness-shire (q.v.), situated at the mouth of the Ness River, where Beaully and Moray firths join, at the head of Glen More, one mile from the northeast end of the Caledonian Canal. It is a commercial and rail center and seaport, and is often called the capital of the Highlands. Chief manufactures are woolen and tweed goods, leather, and whiskey, and there are sawmills, iron foundries, railway shops, and shipyards. The town is noted for the beauty of its environment and its fine buildings. Although it is modern in appearance, it has a long history and was once the capital of the Picts, whom St. Columba visited here about 565 A.D. to convert them to Christianity. Macbeth's castle, which stood in Inverness, was razed by Malcolm III in 1057 to avenge the murder of his father, Duncan I. A new castle was built by Malcolm or his son David I (r. 1124-1153), and William the Lion (r. 1165-1214) made the town a royal burgh.

Oliver Cromwell built a fort in Inverness in 1652, but only a portion of the ramparts remain. The town cross dates from 1685, and at its base stands the ancient stone of Clach-na-Cudainn (Stone of the Tubs). The old castle was partially destroyed by Robert the Bruce in 1307 and finally blown up in 1746 during the Jacobite uprising. A modern castle, now used for county offices, was built on the site in 1835. Pop. (1961) 29,773.

INVERNESS-SHIRE, ĭn-vēr-nēs'shīr, county, Scotland, bounded on the west by the Atlantic Ocean, on the north by the County of Ross and Cromarty, on the northeast by Nairn and Moray, on the east by Banff and Aberdeen, on the south by Perth, and on the southwest by Argyll. It is the largest county in Scotland, 4,211 square miles in extent, and includes some of the islands of the Inner and Outer Hebrides. A large part of the surface is broken and mountainous, and the highest peak in Great Britain, Ben Nevis, which rises 4,406 feet, is in the southwest. Other high peaks are found in the Cairngorm and Monadhliath Mountains. The county is divided by a geological fault which runs from southwest to northeast, called Glen More or the Great Glen, whose lochs, Ness, Oich, and Lochy, are joined in a navigable waterway, the Caledonian Canal (q.v.). There are over 200 lochs and many rivers, the longest being the Findhorn, Spey, Nairn, and Dulnan. Only a small part of the land is cultivated; fishing and grazing are the chief occupations, and there is quarrying of slate, granite, and quartz. Industries include spinning and weaving of woolen goods, brewing, distilling, sawmilling, shipbuilding, chemical

manufacture, and aluminum processing. The chief towns are Inverness (q.v.), Fort William, and Kingussie. Gaelic is spoken by over 23,000 persons. Inverness was occupied by the Picts in Roman times, and was incorporated into the kingdom of Scotland by Malcolm III (d. 1093). The clan system attained its greatest power here, but broke up after the defeat of Charles Edward Stuart (Bonnie Prince Charlie) at the Battle of Culloden Moor in 1746. Many remnants of prehistoric cultures, such as lake dwellings and stone circles, are scattered throughout the county, as well as towers and forts built by the Picts.

In the literature concerning Scottish legend and history, Inverness-shire occupies a considerable place, forming the background for the story of the Bruce and the Jacobite rising of 1745. Sir Walter Scott's poem, *The Lord of the Isles* (1815), and his novel, *The Legend of Montrose* (1819), may be especially noted, while his diary of a yachting tour has much about the island parts of the country. These same islands inspired the famous anonymous poem, *From the Lone Shieling*, and much about them and the mainland will be found in Dr. Samuel Johnson's *A Journey to the Western Islands of Scotland* (1775). Robert Burns (1759-1796) records his associations in his song on *The Lovely Lass of Inverness*. Pop. (1951) 84,924.

INVERSION, ĭn-vûr'shûn, a change of order whereby the first becomes last and the last first. *In rhetoric*, it signifies a reversal of the natural order of words for the sake of euphony, emphasis, or the like; also the turning of one's own argument against him by an opponent in discussion. *In chemistry*, it means a change in molecular structure which is usually induced by fermentation or by heating with a dilute acid, as in the case of starch or sugar. Thus starch and dextrine are changed into glucose, cane sugar into invert sugar, and maltose into glucose. *In geology*, inversion is the overturning or folding over of strata by an igneous agency, so that the order of their succession seems reversed. *In mathematics*, it is the operation of changing the order of the terms, so that the antecedent takes the place of the consequent and the reverse, in both couplets. Thus, from the proportion $a : b :: c : d$, we have, by inversion, $b : a :: d : c$.

In music, inversion is the transposition of certain phrases having a common root, as: (1) the change of a chord by making one of the inner notes act as a bass note, by which means as many inversions can be made as there are actual notes in the chord, not counting the root, the harmony in such inversions remaining the same, though the order of component parts is changed; (2) the alteration of intervals by making that which was the upper note the lower, and the reverse, the inversion of an interval within the octave being readily found in the difference between the number 9 and the interval known; or (3) the alteration of a subject produced by inverting the intervals of which it consists.

INVERSNAID, ĭn'ver-snâd, village, Scotland, in Stirlingshire, on the northeast bank of Loch Lomond. Nearby on the lake shore is Rob Roy's Cave, where Robert Bruce hid after his defeat by the English at Methven (1306). Here also William Wordsworth met (1803) the lass celebrated in his poem *The Highland Girl* and later also in *Three Cottage Girls*.

INVERTASE, ĭn-vûr'tās, or **INVERTIN**, ĭn-vûrt'ĭn, an enzyme occurring in many fungi, notably in certain yeasts (for example, the saccharomyces), and also in the seed plants. It transforms cane sugar into a mixture of dextrose and levulose; this mixture being called invert sugar because it turns the plane of polarized light to the left, while the cane sugar from which it is obtained turns it to the right. It has sometimes been held that a yeast cannot invert cane sugar except by secreting invertase; but *Monilia candida* effects the inversion, and yet produces no invertase. In this case the action is probably due to some other enzyme, hitherto unidentified. Invertase probably plays a very important part in vegetable chemistry. Like other enzymes, it can apparently perform an unlimited amount of chemical work, without sensible diminution of its own substance. Invertase is most active at a temperature of from 120° to 140°F., and in a slightly acid medium. It has been isolated in the form of a powder. See also **ENZYMES**.

INVERTEBRATES, ĭn-vûr'té-brâts, a collective term for those divisions or phyla of the animal kingdom that lack a vertebral column (backbone) or the forerunner of the backbone, the notochord, used to contrast with the highest phylum of the animal kingdom, the Chordata, which possess either a vertebral column (the vertebrates) or a notochord or both. The distinction between invertebrates without an internal skeleton of cartilage or bone and the vertebrates with such a skeleton was first recognized by the chevalier de Lamarck about 1800, but many years elapsed before certain groups of animals without such a skeleton were recognized as possessing a notochord and hence were aligned with the vertebrates to make the phylum Chordata. The name Invertebrata is not used as a taxonomic category because the invertebrates comprise some 20 phyla, each of which is coordinate with the phylum Chordata, and because these phyla show no close relationship to each other, but the term "invertebrates" is in constant use among zoologists in the collective sense mentioned.

INVESTIGATION, Criminal, ĭn-vēs-tĭ-gā'shûn. Criminal investigation is a field, separate and distinct, with its own specialized methods and techniques. The vital importance of crime to the national life has necessitated the development of investigative techniques which could make available evidence to identify the guilty and to exonerate the falsely accused.

The field of criminal investigation in the United States has been shaped by the democratic tradition of the nation. The law-enforcement officer, in investigating crimes, must locate evidence which can be introduced in a court of law. He must conquer the criminal by superior investigative ability and techniques, operating at all times within the realm of the law. The rights of every individual, even of the criminal himself, must be scrupulously observed. The peace officer's powers are limited, defined and continually scrutinized by the courts.

The judicial system of the United States, likewise, has affected the techniques of modern criminal investigations. The law-enforcement officer is the investigator, not the prosecutor. He does not, on his own initiative, authorize or decline prosecution, express recommendations or make evaluations. This duty belongs to the

prosecutor who, if the case goes to trial, will present in court the evidence secured by the investigator. The investigating officer, of course, may testify in court—not concerning his personal opinions or feelings, but the facts as determined through his inquiries. These requirements demand that the criminal investigation be impartial and objective, the facts obtained without color or bias.

Criminal investigation, of course, is a separate field only in reference to the development of specialized standards and a professional code of conduct. In reality, the investigation of crime is closely related to, and dependent on, many fields of human endeavor. The criminal, in preying on society, touches many phases of life. He is, unfortunately, universal in nature, appearing, in some shape or form, in practically every profession or occupation. Law enforcement, in order to meet his challenge, must combat him on his own ground. If the thief, for example, has utilized an acetylene torch in a burglary, law enforcement must familiarize itself with acetylene torches—this process might provide valuable clues. Or in other instances the investigating officer might be required to learn something about the manufacture and packaging of shoes, the mining of copper, the manufacture of steel, the building of model trains. Wherever the criminal operates, law enforcement too must operate—and draw fully upon the knowledge and technical know-how of the component elements of society.

Science.—In its many ramifications, science has become an integral part of criminal investigative work. Metallurgy, toxicology, serology, firearms identification, hairs and fibers, petrography, document examination, spectrography: these facets of science are rendering yeoman service, day after day, to criminal investigators. A scrap of paper, a broken lead pencil, a chip of paint, a tangled thread—these items, under the enlightening glow of science, may reveal the clue which will solve the case. Science gives precision, objectivity and perspective to the peace officer.

The FBI Laboratory, for example, examines each year thousands of pieces of evidence for America's law enforcement agencies. The Laboratory, which is equipped with the latest scientific instruments, is staffed with highly trained technicians, each an expert in his particular field. Science today is highly specialized. For law enforcement to benefit, directly and indirectly, from every aspect of science, expert technicians must be used. Specimens range from bicycles to baby carriages, specks of dirt to fraudulent checks, a rusty firearm to a poison pill. The entire sweep of scientific knowledge, a sweep which each year is becoming greater, is being brought to bear in behalf of the scientific investigator.

The impact of science upon criminal investigations may be illustrated by citing a few specific examples:

The analysis of body fluids (serology) is an important adjunct of the investigation of crimes, such as murder, assault and hit-and-run accidents. The most frequent examination of this type is to determine the presence of blood. If blood is confirmed, additional tests are run to ascertain whether the blood is human or animal. If animal, the type of animal can be determined through the use of sera prepared in the FBI Laboratory. On the other hand, if the blood is human, the technician can determine the blood group of the person from whom the blood came. A suspect

may claim, in reference to stains on his clothes, that they are bloodstains of a dog or some other animal or that they came from his own blood, resulting from a nosebleed or an injury. These chemical analyses, though not providing a positive means of identification, help substantiate or disprove alibis advanced by the suspects.

Another application is in the field of petrography, which includes the study of crystalline substances, soils, and minerals. The Laboratory expert, through the use of the petrographic microscope, which utilizes polarized light, is able to examine soil samples, identify their contents, and compare them with other samples obtained at the scene of the crime or elsewhere in the course of the investigation. The examination of dirt adhering to a suspect's shoes or in his trouser cuffs may be helpful in disproving or verifying an account of his whereabouts at a particular time, or in furnishing circumstantial evidence indicating that the suspect had been at the scene of a crime. Likewise, examination of a suspect's or victim's clothing may reveal the presence of mineral matter or industrial dust, which, upon analysis, may furnish data regarding his occupation or environment.

Science has enabled the criminal investigator, for example, to make dyes, which are associated with many objects of everyday life, such as clothing, plastics, wood, and inks into firm and dependable allies. The FBI Laboratory analyzes dyes by means of a spectrophotometer. This instrument, which allows the various colors of the spectrum to pass, one at a time, through the dye, which has been placed in solution, records in graph form the special characteristics of the dye. These graphs serve as ready references to identify dyes submitted in the future to the Laboratory.

In still another aspect of criminal investigation, that is, the analysis of documents, science has come to the aid of the law enforcement officer. The altering, forging and illicit issuance of checks represent today a major problem for every police department in the nation. The FBI Laboratory is able, through various chemical and mechanical devices, to identify a great percentage of the fraudulent checks which are submitted. Ultraviolet light brings forth erasures. Latent fingerprints can be developed, and through the operation of the National Fraudulent Check File numerous professional confidence men can be identified. This file, which contains many thousands of fraudulent checks, is composed of a number of sections. Checks are filed according to the method of preparation, for example, by handwriting, hand printing, and mechanical methods of preparation, such as typewriting and checkwriting. Each fraudulent check received is searched through the appropriate section of this file. If an identification is made the submitting agency will be furnished not only with background information about the individual involved, but also, if available, his arrest record and photograph. In many instances the subject is already in custody, and the contributor will then be informed as to the individual's location. If the fraudulent check cannot be identified, a photographic copy is placed in the file for comparison with other checks subsequently submitted for examination.

The National Fraudulent Check File is illustrative of the role which standard comparison files today play in criminal investigative work. These files contain specimens of known standards

which are used for comparison with unknown material submitted. Time after time, through these comparisons, identifications are effected. The FBI Laboratory, for instance, maintains such files, among others, as the Rubber Stamp File, Paper Watermark File, National Automotive Paint File, Shoe Print File, and Tire Tread File.

In the Tire Tread File the FBI Laboratory has attempted to keep currently on hand the blueprint specifications of tread and side-wall designs produced by tire manufacturers throughout the country. An investigating officer who finds what appears to be a significant tire tread at the scene of a crime can photograph it, make a sketch drawn to scale, and then make a plaster cast of it. When these are sent to the FBI Laboratory, examiners can frequently identify the tread as a particular brand and give the contributor valuable investigative information as to the size, brand, manufacturer and distributor of the tire which made the questionable tread. The identification can be made more readily from a good plaster cast than from photographs or sketches; and a good photograph is, of course, better than a sketch. The FBI's Tire Tread File also contains retread and recap designs currently in use. Although any design may be reproduced in recap or retread work, it is still frequently possible in the Laboratory to tell whether a print was made by a recapped or retreaded tire. Moreover, many retreading and recapping companies develop original designs, some of which are peculiar to certain localities and readily identifiable.

Science admittedly has greatly affected criminal investigations. However, the significance of science must be gauged, not in the past, but in the future. In the years ahead science, with ever increasing speed and accuracy, will tear away the shrouds of darkness, doubt and uncertainty. The unsolved case of today will become, with the aid of science, the solved case of tomorrow. The law enforcement officer, to keep abreast of the criminal, must constantly utilize the latest developments of science.

The FBI Laboratory, in this connection, is carrying on research programs designed to elicit new scientific applications and techniques. The latest scientific equipment is being brought to bear on investigative work. For example, the assistance rendered to scientific crime detection by the FBI Laboratory has recently been immeasurably increased through the operation of the electron microscope. This instrument, which has ten times the magnification of a high power light microscope, has enabled the FBI Laboratory to make examinations of evidence which previously had been impossible.

The electron microscope embodies an entirely new approach in the field of magnification. The use of light waves and glass lenses, necessary requirements of the ordinary microscope, are eliminated in favor of electrons, operating in a vacuum and passing through magnetic lenses. This process enables the FBI Laboratory to obtain magnifications of approximately 22,000 times, which may be increased, by use of photographic enlargements, to 100,000 times. The examiner, thereby, is capable of making a more detailed and exhaustive analysis.

The FBI Laboratory is able through the electron microscope, not only to examine more closely and extensively specimens of evidence but, by means of an electron diffraction attachment, to

determine the identity of very minute unknown substances submitted for examination. The diffraction attachment creates a diffraction pattern, similar in appearance to a series of concentric circles, which, when studied, reveals the nature of the substance in question. This feature of the electron microscope will make available to law enforcement officers investigative clues previously inaccessible to them.

The electron microscope is symbolic of what science can do for law enforcement. This instrument, though only in its infancy as applied to criminal investigations, offers unlimited possibilities.

Fingerprints.—For many years fingerprints have played an invaluable role in criminal investigative work. Man for centuries has utilized various systems of identification, such as branding, tattooing, distinctive clothing, photography and body measurement (Bertillon system). These systems, without exception, have not produced completely desirable results. Only fingerprinting, of all the methods of identification, has proved to be both infallible and feasible.

The science of fingerprinting for identification purposes is based upon distinctive ridge outlines which appear on the bulb on the inside of the end joint of the fingers and thumbs. These ridges have a definite contour and appear in several general pattern types, each with general and specific variation of not only the pattern but also the size and thickness of the ridges and the size and spacing of the pores. The outlines of these ridges appear most clearly when inked impressions are taken upon paper, so that the ridges are black against a white background, caused by the failure of the ink to fill the depressions between the ridges. Impressions may also be made with blood, dirt or the greasy substance emitted by the sweat glands through the ducts or pores which constitute their outlets. The background or medium may be paper, glass, porcelain, wood, wax, putty, silverware, or any smooth, nonporous material.

Criminal identification by means of fingerprints is one of the most potent factors in obtaining the apprehension of fugitives who might otherwise escape arrest and continue their criminal activities indefinitely. The peace officer is enabled not only to locate dangerous and badly wanted criminals, but to secure complete and accurate information about a prisoner's previous criminal history and to solve cases which previously had baffled the best investigative techniques.

The FBI's Identification Division, founded in 1924, possesses the largest collection of fingerprints in the world. At present over 114,000,000 fingerprint cards are on file. They are divided into the criminal and noncriminal files. The criminal files contain roughly 19,000,000 sets of prints, representing over eight million individuals. The non-criminal, or civil identification files, account for more than 80 per cent of the fingerprints. They contain the fingerprints of members of the armed forces, government employees, individuals who were fingerprinted while applying for jobs in defense plants during World War II, and persons who voluntarily have had their fingerprints recorded as a permanent means of identification. This latter group includes private citizens, club members, Boy Scouts, and others interested in the science of fingerprinting.

The Identification Division of the FBI has

steadily increased in size and effectiveness over the years. In 1924, at the time of its founding, the Identification Division consisted of 810,188 fingerprint cards. These cards represented a consolidation of the fingerprint collections of the National Bureau of Criminal Identification, sponsored by the International Association of Chiefs of Police, and the Leavenworth Penitentiary Bureau. In its first year of existence, the Identification Division received and handled 104,660 fingerprint cards, a daily average of less than five hundred. By the end of the 1942 fiscal year, fingerprint cards were coming in at the rate of over 114,000 a day and the total number on hand rocketed to nearly 43,000,000. The peak year for the Identification Division was 1943, when a total of 28,733,286 fingerprint cards was received. This great avalanche of cards resulted from the wartime activities of the nation. In the 1949 fiscal year, a total of 3,508,480 cards, or a daily average of 13,867, was received.

The effectiveness of the Identification Division has increased with the volume. In the 1925 fiscal year, when less than a million prints were on file and fewer than five hundred records a day were being received, 22.4 per cent of all arrest fingerprint cards received were identified. In 1949, with over 112,000,000 prints on file, this percentage had risen to 73.68.

Fingerprints, day after day, are performing feats of accomplishment for the peace officer. A set of fingerprints received by the Identification Division in the morning may result in the apprehension of a fugitive before nightfall. In February 1950, for example, the Identification Division identified 841 fugitives and maintained notices in its files on a total of 82,893 wanted persons.

The Identification Division serves as a national clearinghouse for fingerprints in the United States. In addition, through the international exchange of fingerprints criminals who have fled across national boundaries can be identified and located. The FBI in the 1949 fiscal year maintained an exchange service with 79 foreign countries and territorial possessions. A total of 13,975 fingerprint records were exchanged. The FBI succeeded in identifying, with previous records, 23.89 per cent of the fingerprint cards received from outside the country. Approximately eleven (10.75) per cent of those transmitted from this country were identified by the recipients with records previously on file.

Fingerprints serve, in addition to their criminal functions, many humanitarian purposes. For example, they aid in the location of missing persons, frequently absent from their homes for many years; the identification of amnesia victims; identification of mutilated bodies of servicemen killed in action and unidentifiable by any other means; the determination of the identities of victims, otherwise unidentifiable, of airplane crashes, railroad wrecks, or disasters by fire, explosion and accident.

Personnel Training.—Criminal investigations, in the final analysis, depend upon the men who perform them. The latest scientific equipment can be available, the most complete system of records in operation, but unless the employees in every position—administrator, supervisor, investigating officer—possess technical know-how and training, the quality of investigations will be low. The training of the criminal investigator, in present day law enforcement, is an item of the most extreme importance.

Law enforcement, unlike that of 25 years ago, is today a profession which must handle many complicated and involved problems. The peace officer often is required, with but a few seconds' notice, to conduct a crime scene search, perhaps at the site of a murder, the hideout of a bank robber, or at the locale of an extortion payoff. He must be able to handle, with dispatch and precision, the problem at hand. The evidence, an hour, even ten minutes later, may be moved or destroyed. Witnesses will have disappeared. The law enforcement officer must possess thorough training in criminal investigative techniques, training which he can apply instantly and efficiently.

Trained law enforcement personnel is vital, not only for the solution of criminal cases, but for the protection of the general public. The peace officer, among many other things, must be meticulously schooled in the use and maintenance of firearms. He carries a hand weapon. This gun, in untrained hands, can wreak terrific damage on innocent individuals. The law enforcement officer must know safety precautions, the correct way to shoot the weapon, where and in what cases to fire. Indiscriminate and irresponsible gunfire by law enforcement is indefensible. The trained officer will use the weapon, and other features of law enforcement, with a very minimum of risk, for the protection of society.

Every efficient, up-to-date law enforcement agency will have, in some form or other, personnel training programs. New recruits must be taught the rudiments of law enforcement; experienced officers must keep abreast of new developments. Training classes enable the group to share and benefit by the experiences of others; to learn the proper methods of handling scientific equipment; to know in what ways other law enforcement agencies and officers can assist. The successful criminal investigator blends individual initiative and skill with group knowledge and technical know-how.

The FBI, for example, conducts a 14-week training school for new Agents. These men, before they are assigned to actual investigative work in the field, learn the correct techniques and methods of operation: firearms, crime scene searches, fingerprints, laboratory work, mechanics of arrest, report writing. They are given both classroom instruction and practical demonstration work. The training classes are designed to equip them to meet the actual problems which they will encounter in investigative cases. When these Agents leave the school, however, their training does not stop. Approximately every two years they return to Washington, D. C., for a two-week refresher course, where they are acquainted with the most recent developments in law enforcement work. In between these in-service training classes the Agents are given training at regular intervals in their offices of assignment.

The FBI, through the FBI National Academy, has attempted to assist in the training of local police officers. This school, founded in 1935, is designed to train selected peace officers to be police instructors and executives. These men are given a twelve-week training course, which includes instruction in such subjects as traffic control, police organization and administration, investigative techniques, firearms, the operation of police laboratories, and fingerprints. The final two weeks are devoted to specialized topics which

afford the individual officer an opportunity to study particular fields most applicable to his department. There is no charge for the training by the FBI. The student must pay only for his travel and personal living expenses while in Washington, D. C.

In addition, the FBI, in 1949, participated in 2,509 local police training schools. These schools provide, on a local basis, training of the type offered in the National Academy to law enforcement officers throughout the nation. The initiative in setting up schools is taken by the local agencies and the FBI participates only upon specific request. Normally most of the instruction is given by FBI Agents and FBI National Academy graduates.

To perfect a new technique of criminal investigation is not enough. This information must be transmitted to the rank and file of law enforcement. The success of criminal investigations is dependent on the investigating peace officer making science, fingerprints, and other techniques work for him. And to accomplish this, to translate theoretical knowledge into practical application, is the work and responsibility of the training program.

Each criminal case presents different problems. The key of solution in one case, perhaps fingerprints, document examination, firearms identification, spectrographic analysis, will not necessarily solve another case. Crimes may appear, from original observation, to be identical, but, almost invariably, intensive investigation will reveal that they are different, usually much different. The same criminal, or gang, specializing in a particular type of violation, will approach the problem differently, leave different clues, make dissimilar getaways. A murder, to the criminal investigator, is not a murder to be investigated like all other murders. The officer, drawing from general principles of investigative procedure, must, in each instance, apply the key which appears most likely to solve the case.

The criminal investigator has today at his disposal powerful weapons of crime detection. Each day his abilities, through development of new techniques, are being increased. But in the final analysis the esprit de corps of the investigator, the will to do the job, is the most potent tool in the hands of law enforcement. The very best tools, handled by the half-hearted officer, become rusty and dull. The alert investigator, even with inadequate equipment, can do good work. Capable personnel supplied with adequate working tools—this is the only way the quality of criminal investigations can be maintained at a consistently high level.

J. EDGAR HOOVER,

Director, Federal Bureau of Investigation.

INVESTITURE, the act of investment implying the right to give possession of an office, honor, benefice or manor. In the mediaeval or feudal law, it was the open delivery of a feud or a right to lands and hereditaments, by a lord to his vassal, thus, by external proof, affording evidence of proprietorship. To use the words of Blackstone, "Investitures, in their original rise, were probably intended to demonstrate, in conquered countries, the actual possession of the lord, and that he did not grant a bare litigious right, but a peaceable and firm possession. At a time when writing was seldom practised, a mere oral gift, at a distance from the spot that was

given, was not likely to be long or accurately retained in the memory of by-standers, who were very little interested in the grant." For this reason investiture was performed by the presentation of some symbol to the person invested, as a branch of a tree, etc. In the primitive church, after the election of a bishop, and his consecration, the early Christian emperors claimed a right of confirmation. Charlemagne is said to have introduced this practice, and to have invested the newly consecrated bishop by placing a ring and crozier in his hands.

The custom, however, existed, nor does it appear to have been objected to or opposed during the lapse of two centuries from his reign. The disorderly state of Italy, which succeeded the death of Charlemagne, frequently interrupted the exercise of this right by the Carolingians; but even so late as 1047, when the empire had passed to another line, Henry III received an explicit admission of his prerogative, and repeatedly used it. The investiture in the lesser sees followed as a matter of course. Alexander II issued a decree against lay investiture in general, which was revived by Gregory VII (Hildebrand), who, having succeeded in annulling the prerogative of the emperors to nominate or confirm popes, sought to disjoin entirely the ecclesiastical from the civil rule. It was not, however, until the papacy of Calixtus II, in 1122, that the question was terminated, as it appears, materially to the advantage of the Holy See. In France, even under the papacy of Hildebrand, the right of investiture does not appear to have been made a subject of open quarrel. In spite of the protests of the Holy See, the kings exercised the power, but at length relinquished the presentation of the ring and crozier, and contented themselves with conferring investiture by a written instrument, or orally, upon which they were left in peaceable possession of the power. But in England Paschal II was engaged in a contest little less fierce than that which he maintained with the emperor. Anselm, the primate, refused to do homage to Henry I for his see. The king seems to have asserted an unqualified right of investiture, which the pope, who was appealed to, as unqualifiedly denied. After a protracted struggle, and continued threats of excommunication, the controversy ended in England, as it did afterward in Germany, by compromise. Paschal offered to concede the objections against homage provided Henry would forego the ceremony of investiture. To this he agreed (1107).

INVESTMENT BANKERS ASSOCIATION. See BANKS AND FINANCE—27. *Bankers' Associations.*

INVESTMENT BANKS AND BANKING. See BANKS AND FINANCE—24. *Investment Banking.*

INVINCIBLES, an Irish secret society of 1882, an off-shoot of the Fenians (q.v.). One of the objects of the Invincibles was, to "remove" or assassinate government officers or others who might incur the displeasure of the association or its leaders. On May 6, 1882 the society succeeded in "removing" Lord Frederick Cavendish, who had just arrived from England as Secretary for Ireland, and Thomas A. Burke, the under-secretary, in the Phoenix Park at Dublin. The plot was directed against the lat-

ter, but because Cavendish was there he also was stabbed fatally by the nine Invincibles making the assault. The trial of those charged with complicity in the murders began on Feb. 20, 1883; five were condemned to death, and the others received prison terms. The chief witness for the prosecution was James Carey, a leader of the Invincibles since 1881, whose life was threatened because he informed on the group. He and his family were secretly placed on a ship bound for South Africa, but the Invincibles learned of the plans and succeeded in getting one of their members aboard. Carey was shot dead by this man on the ship near Natal on July 29, 1883.

INVOICE, ĭn'vois, a list or bill of goods; a detailed statement of merchandise shipped to a consignee. Invoices generally list the quantity of material, its price, and the charges incurred for shipping. An invoice often accompanies a shipment of goods along with the bill of lading from the consignor to the consignee. It is not a document of title or a contract of sale, and it has no value in law other than as a memorandum. When goods are shipped to foreign countries, consular invoices must frequently be signed by the consul of the country of destination.

INVOLUCRE, ĭn'vô-lŭ-kēr, in botany, a group of bracts surrounding flowers or fruit and occupying a place on the floral axis beneath the cluster of blooms or fruit. Involucres are particularly characteristic of the Compositae.

INVOLUTE. See EVOLUTE.

INVOLUTION, ĭn-vô-lŭ'shŭn, in mathematics, the raising by multiplication of a quantity to any assigned power. It is the inverse of evolution, in which the root of a quantity is extracted. See also ARITHMETIC—*Fundamental Operations* (Involution).

INVOLUTIONAL MELANCHOLIA, ĭn-vô-lŭ'shŭn-ăl mël-ăn-kô'li-ă, a psychotic condition which occurs during middle age. It is associated with the waning of physical vigor and generally appears between the ages of 40 and 60, being somewhat earlier for women than for men. The most common characteristic of involutional melancholia is mental depression, acute and intense. Self-recrimination, anxiety, fear, and attempts to commit suicide are features of the disease. Some patients exhibit symptoms of schizophrenia.

IO, ĭô, in Greek mythology, a priestess of Hera at Argos. According to most accounts she was the daughter of the river god Inachus. Zeus fell in love with her and, to protect her from the jealousy of Hera, changed her into a beautiful white heifer. Hera was not deceived, however, and sent a gadfly to torment Io, who was thus persecuted through many lands. Finally she reached Egypt, where Zeus restored her to her former condition and fathered her son Epaphus, ancestor of Danaus. Io has often been associated with Isis in Egypt. Her wanderings were a favorite subject in Greek poetry and painting.

In astronomy, Io is the traditional name applied to Jupiter's Satellite I, one of the four inner satellites discovered by Galileo in 1610, the first time any of the satellites of Jupiter was observed. See also JUPITER—*Satellites*; SOLAR SYSTEM.

IOANNINA, yô-ă'nyê-nă (formerly YANINA or JANINA, yă-nê-nă), city, Greece, in northern Epirus, capital of the Nome of Ioannina, situated on Lake Ioannina, approximately 200 miles northwest of Athens. The commercial center for an area producing grain, fruit, and wine, Ioannina has numerous silk and textile mills, and the gold and silver embroideries for which it was long famous are still manufactured. There is an airport. The city is the seat of a metropolitan of the Greek Orthodox Church and contains a number of early churches. There are many Byzantine ruins, including those of an ancient fort called the Iron Castle.

Ioannina was founded in Byzantine times. It was seized by the Normans in 1081, but soon reverted to imperial control and in 1204 became the capital of the despotate of Epirus, established by Michael Angelus Comnenus. Held by the Turks from 1431 to 1913, it was the residence of Ali Pasha, the Lion of Janina, from 1788 to 1822. Under Ali the city was very prosperous and became a prominent center of neo-Hellenic culture. After the First Balkan War, in 1913, it was annexed to Greece. It was heavily damaged during World War II. Pop. (1951) 32,315.

IODINE, ĭô-dĭn, the heaviest member of the halogen family of the chemical elements. The atomic weight is 126.91, and its atomic number is 53; its symbol is I. An isotope, I^{131} , occurs in the earth's crust, but no less than 18 radioactive isotopes of this element have been made, of which I^{131} is the most important.

Iodine is a solid at room temperature and melts at 113° C. Its boiling point is 184.35° C. The density of solid iodine is 4.94 at 20° C. In appearance it varies from a dense bluish black mass to lustrous crystals of the orthorhombic type. Iodine is slightly soluble in water, but is quite soluble in solutions containing inorganic iodides. It also dissolves readily in several organic liquids, including ethyl alcohol, diethyl ether, toluene, *p*-xylene, benzene, and carbon disulphide.

The discovery of iodine in 1811 or early 1812 is credited to Bernard Courtois, but the element was definitely isolated, described, and named by Joseph Louis Gay-Lussac in 1813. Its present name is derived from a Greek word (*iôdēs*) for the color of violets, because of the appearance of its vapor.

Iodine has seven electrons in its outermost orbit, and thus has a negative valence of one and positive valence of one to seven. Although not as active chemically as the other halogens, it forms compounds with most other elements except sulphur, selenium, and the zero-valence gases. It is a mild oxidizing agent and also a valuable catalyst.

Sources and Production.—Iodine is a relatively rare element in nature, but is present in sea water to the extent of 0.05 per cent. Brown seaweed has the ability to take up and concentrate this element until it contains, on the dry basis, as much as 0.45 per cent of iodine.

As early as 1840, iodine was discovered in the nitrate deposits of Chile, where it exists as an iodate. This is still the principal commercial source of iodine. Shortly after World War I, iodides were found in oil well brines in Louisiana and later in those of California. The latter furnishes most of the domestically produced iodine of the United States, but much greater quan-

tities are imported from Chile. The consumption of iodine in the United States is of the order of a million pounds per year.

Only a fraction of the iodine contained in the crude *caliche* from which sodium nitrate is produced in Chile is recovered each year, because of the limited quantities of iodine employed in the chemical industry. In fact, it is regarded as a fine chemical in contrast to heavy chemicals.

Iodine is obtained in Japan from the ashes of seaweeds by leaching the soluble sodium iodide, from which the free element is produced. Chilean nitrate iodine is liberated from the mother liquors of the nitrate industry by means of sulphurous acid, and the crude iodine is filtered, pressed, and sublimed from cement-lined retorts. American iodine from brines has been produced by a variety of processes, of which the simplest resembles that for the recovery of bromine from sea water, involving the blowing out of iodine by chlorine from an acid solution. The iodine is recovered from the vapors as hydriodic acid by scrubbing with sulphurous acid, and is converted to the element from concentrated solutions of the halogen acid by a second treatment with chlorine.

Derivatives.—The most common and important inorganic iodine derivative is hydrogen iodide (HI). It is a gas at ordinary temperatures, while its water solution is known as hydriodic acid. Potassium iodide (KI) is a commercial chemical and is the source of most of the iodides of other metals. Iodine also combines with other halogens, the two most common compounds being iodine monochloride (ICI) and iodine trichloride (ICl₃). Iodine pentoxide (I₂O₅) is a common chemical, of particular value because it oxidizes carbon monoxide to carbon dioxide, making possible the ready determination of the dangerous carbon monoxide substance. Iodic acid (HIO₃) and iodates (salts) are powerful oxidizing agents.

In the organic field, methyl iodide (CH₃I) is a standard methylating agent and fumigant, while methylene iodide (CH₂I₂) is a heavy liquid (specific gravity, 3.325) by means of which minerals may be separated. Iodoform is a medicinal disinfectant.

Uses.—Iodine and many of its compounds are of great value in chemical research. When iodine is used as an analytical reagent, the operation is known as *iodimetry*; when iodides are employed to determine the quantities of another substance that will liberate the iodine in them, the analysis is called *iodometry*. In either case, free iodine is determined by titration with sodium thiosulphate, the reaction being $3I_2 + 6Na_2S_2O_3 = 3Na_2S_4O_6 + 6NaI$. The indicator in thiosulphate titrations is a thin suspension of starch, which adsorbs free iodine to give a blue color. The indicator is not added until most of the iodine is converted to iodide to ensure a sensitive color change from blue to colorless. Many inorganic analyses depend on the use of iodine, and it also has many important applications in the field of organic analysis. Solutions of iodine or the monochloride bring about additions to double bonds of the glycerides of fatty acids, and by the use of rigidly standardized methods, animal and vegetable oils may be accurately identified. The term "iodine number" is the weight in grams of iodine that is taken up by 100 grams of an oil.

Iodine is of great importance in medicine, particularly in connection with the thyroid gland. The active thyroid hormone is a protein complex

containing the substance thyroxin (C₁₅H₁₁NO₄I₄). Radioactive iodine (I¹³¹) is employed in diagnosis and treatment of hyperthyroidism and thyroid cancer.

In the industrial field, although a fine chemical, iodine and its compounds find varied applications. Very pure titanium can be prepared by the formation of volatile titanium tetriodide, with decomposition and deposition on a vertical wire in the furnace. Silver iodide (AgI) is an ingredient of most photographic emulsions, being prepared from silver nitrate and potassium iodide and incorporated directly in the gelatin coating of films. It is also effective in very small quantities in the seeding of clouds to produce rain. Esters of hydriodic acid are organic reagents. Sodium iodide is added to table salt to prevent goiter. Several dyes contain iodine, such as rose bengale, iodine green, and erythrosin, the last being a certified food color and tissue stain. Numerous iodine preparations, of which iodoform and tincture of iodine are typical, are standard pharmaceuticals.

W. T. READ,
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IODOFORM, i-ô'dô-fôrm, triiodomethane (CHI₃), an antiseptic once in very general use, but now largely displaced by more effective pharmaceuticals. It occurs as a yellow crystalline solid and melts at 119°C. Its density is about four times that of water. While only slightly soluble in water, it dissolves readily in benzene and acetone, is quite soluble in boiling alcohol, and very soluble in cold ether and carbon bisulphide. It was formerly employed in dressing wounds, but is somewhat irritating and may cause dermatitis. It still has some use in veterinary medicine, but when cows are treated with it, iodoform may appear in the milk.

Iodoform may be made from any organic compound containing a methyl group linked to a carbonyl group, as CH₃CO—, or a substance from which this group can be formed. The reaction is a quantitative test for such a group in organic analysis. Iodoform is made industrially by electrolyzing acetone or ethyl alcohol solutions of an inorganic iodide in the presence of sodium carbonate, or by the action of an alkaline solution of sodium hypochlorite on an iodide dissolved in alcohol or acetone. It also results from the interaction of chloroform (CHCl₃) and methyl iodide (CH₃I). Iodoform in alkaline solution oxidizes such compounds as arsenites to arsenates. Not more than five or six tons of iodoform are produced annually.

W. T. READ.

IOLA, i-ô'lâ, city, Kansas, seat of Allen County, situated on the Neosho River, 109 miles southwest of Kansas City, at an altitude of 960 feet. It is served by the Atchison, Topeka and Santa Fe, the Missouri-Kansas-Texas, and the Missouri Pacific railroads, and there is a municipal airport; the city is at the intersection of several U.S. highways. Iola is the commercial center for an important grain, livestock, and dairy farming district. Creameries and plants for condensing milk and processing food are in the city, and there are also factories for making bricks, cement, and clothing. Iola Junior College is located here, and the public library contains collections of state history materials and works by Kansans. Laid out in 1859, Iola became

a county seat in 1865 and was incorporated in 1870. It has a commission form of government. Pop. (1960) 6,885.

IOLANTHE, IOLANTA, or YOLANTA, opera in one act by Peter Ilich Tchaikovsky, with libretto by his brother Modest Ilich Tchaikovsky, based on the chivalresque play *King René's Daughter* by the Dane, Henrik Hertz. This, Tchaikovsky's last opera, was played for the first time at St. Petersburg on Dec. 17, 1892, on a double bill with the première of his ballet *The Nutcracker (Casse-Noisette)*. Although *Iolanthe* won temporary success in Slavic and Scandinavian countries, and has been revived there and in Central Europe in the mid-20th century, it seems never to have been given professional staging in England or the United States.

HERBERT WEINSTOCK.

IOLANTHE; OR THE PEER AND THE PERI, i-ô-lân'thê, pē'ri, operetta in two acts by Sir Arthur Sullivan, with libretto by William S. Gilbert. *Iolanthe* was first performed simultaneously at the Savoy Theatre, London, and the Standard Theater, New York City, on Nov. 25, 1882, running in London for 398 nights.

Act I.—Arcadian Fairyland. The Fairy Queen is persuaded to pardon the fairy Iolanthe, who for 25 years has been in exile as punishment for marrying a mortal. Iolanthe's son, the half-fairy, half-mortal Strephon, born after she left his father, wants to marry Phyllis, a shepherdess not yet of age; but Phyllis' guardian, the Lord Chancellor, has withheld his consent. The peers convene and try to persuade Phyllis to marry one of them, but she wants only Strephon. The lovers are separated. Mistakenly thinking Strephon unfaithful to her, Phyllis agrees to accept one of the peers. Strephon appeals to Iolanthe for help. She induces the Fairy Queen to arrange for Strephon to sit in the House of Peers, where he can upset all of his colleagues' political schemes.

Act II.—The Palace Yard, Westminster. After Private Willis, the sentry, sings a song, it becomes clear that the irresistible Strephon is creating havoc in the House of Peers. Phyllis has become engaged to both the Earl of Tolloller and the Earl of Mountarat, between whom she cannot choose. The Lord Chancellor decides to solve all problems by marrying Phyllis, whereupon Iolanthe, at the risk of her life, reveals that he is her husband, and, though he does not know it, the father of Strephon. Several other fairies reveal that they too have married peers and thus share Iolanthe's sin. The Fairy Queen relents and decides to marry Private Willis after changing all of the peers into fairies. Strephon and Phyllis are reunited, and all fly away happily to Fairyland.

HERBERT WEINSTOCK.

ION, i'ôn, in chemistry, an atom or group of atoms which has either lost or gained electrons, and has thereby acquired a positive or negative electrical charge. If the particle concerned has lost electrons, it is a positive ion or *cation*; if the particle has gained electrons, it is a negative ion or *anion*. Such ions may exist in pairs of opposite polarity as chemical units. When created by the dissociation of a chemical compound, the ion may occur variously as an electrically charged atom, molecule, or radical.

A stable solid, liquid, or gaseous compound is also in an electrically neutral state, the positive charge of the metallic ion it contains being electrically balanced by the negative charge (or charges) of its constituent nonmetallic ion. However, if a *polar* dissociating compound is placed in water, a certain number of the metallic ions of the compound separate from their chemical bond with the nonmetallic ion or ions of the compound to destroy the former electrical balance. The charged particles thus released become free ions in the solution. These ions are capable of chemical recombination (ion exchange) to fill the valence electron shells of other atoms and thus form new compounds.

Typically, when a substance such as hydrochloric acid is mixed with water, a process of dissociation occurs as part of the acid separates into charged H^+ and Cl^- ions. If a weak electric current is passed through the solution by means of two metal bars known as electrodes immersed at different points in the solution, a process of ion migration takes place. With the current turned on, as electrons leave the one electrode (anode) to flow into the solution, this electrode with a deficiency of electrons becomes positively charged. Similarly, because of the accumulation of electrons leaving the solution, the opposite electrode (cathode) becomes negatively charged. The positively charged hydrogen ions in the solution thus tend to flow toward the negatively charged cathode, where each seizes an electron to form a neutral, electrically stable hydrogen atom. The negative chlorine ions in solution migrate toward the positively charged anode, where they yield their free electrons to become stable chlorine atoms. (See also ELECTROLYSIS.)

In this capacity of making possible a continuous flow and interchange of electrons between two electrodes and thus permitting conduction of an electric current through a solution, ions also form the basis of a wet storage battery (see BATTERY, ELECTRIC). So-called *nonpolar* (including most organic) compounds formed by sharing electrons in a covalent bond, do not create ions and are therefore nonelectrolytic. They will not conduct an electric current.

In geophysics, the ion represents a charged particle formed from molecules or atoms of atmospheric gas by the ionizing action of ultraviolet rays and X-rays (or by the impact of α particles) from the sun, at high altitudes where the absorbing effect of the earth's atmosphere for these short-wave radiations and corpuscular streams is not as great as at lower levels. Several layers of free ions are formed by these processes in a high-level region of the atmosphere called the *ionosphere*. (See also IONOSPHERICS.)

In physics, ions are the basis for many phenomena of electric discharge tubes, and permit the flow of electric current in evacuated fluorescent and neon light tubes and other such devices.

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IONA, i-ô'nà, island, Scotland, one of the Inner Hebrides, in Argyllshire, about one mile west of the Ross of Mull, from which it is separated by Iona Sound. The island is approximately three miles long and one and one-half miles wide, with a total area of three and one-half square miles. About one third of the land is under cultivation, chiefly to oats, barley, and potatoes. The remaining area consists of hilly

pasture (suitable for grazing), rocky hills, and shell beaches. There is marble quarrying, and fishing and tourism are additional sources of income. The island has no trees.

About 563, St. Columba (q.v.) and his companions came from Ireland and founded the monastery which soon made Iona the most famous center of Celtic Christianity. Missionaries from Iona went to all parts of Scotland and northern England, establishing monasteries and spreading Christianity, while to Iona came students and pilgrims, many of the latter coming to die and be buried in the holy soil. During the 8th and 9th centuries the island was raided many times by Vikings, and the monastery was burned. It was restored in the 11th century by Queen Margaret, wife of Malcolm III MacDuncan of Scotland; she is also said to have built St. Oran's Chapel, the oldest existing building on the island (c. 1080). A new monastery was established in 1203 by the Benedictines, but with the success of the Reformation in Scotland, it was dismantled (1561). The Cathedral of St. Mary has 13th century remains, but dates mainly from the 15th and early 16th centuries, with much subsequent restoration. Also of interest is St. Oran's Cemetery, containing some of the sculptured tombstones of the many early kings and chiefs of Scotland, Ireland, and Norway who were buried on Iona. There are remnants of the numerous crosses which once covered the island, and still standing is the 14-foot Iona Cross, of carved granite, dating possibly from the 9th or 10th century. The Iona Community, a brotherhood of ministers and laymen, has undertaken the restoration of the monastery and other buildings on the island.

IONESCU, yō-ně'skōō, **Take**, Rumanian statesman: b. Ploesti, Rumania, Oct. 13, 1858; d. Rome, Italy, June 21, 1922. Educated in law at Bucharest and Paris, he entered Parliament in 1884, held various ministerial posts, and in 1908 founded the Conservative Democratic Party. At the end of the Second Balkan War (1913) he represented Rumania at the Bucharest Peace Conference, securing the remainder of Dobruja from Bulgaria. Ionescu was a leading advocate of Rumania's participation in World War I on the side of the Allies. After his country entered the war (1916), its armies were crushed by Germany and Austria, but it acquired Bucovina, Transylvania, and Bessarabia at the end of the conflict, thanks in great part to Ionescu's efforts at the Paris Peace Conference. As foreign minister (1920-1921) under Gen. Alexandru Averescu, he negotiated the treaties with Czechoslovakia and Yugoslavia (1921) which formed the basis of the Little Entente, designed to defend the peace treaty awards. He succeeded Averescu as prime minister briefly in 1921-1922.

IONIA, i-ō'nī-ā, ancient district, Asia Minor, covering a narrow strip of land in western Anatolia (Turkey), along the Aegean Sea, and including the islands of Samos and Chios, as well as many other Aegean islands. The mainland area extended about 90 miles, from the mouth of the Hermus (modern Gediz) River to the Halicarnassus (modern Bodrum) Peninsula, going inland about 20 to 30 miles, where it was bordered on the east by the Lydian kingdom. According to tradition the region was settled about 1000, B.C. by Greeks from Attica, who were fleeing the in-

vading Dorian barbarians. Ionia contained the most fertile soil in Asia Minor and, located between the Greek mainland and the Asian hinterland, was well situated for trade. The region prospered and 12 wealthy cities arose: (north to south) Phocaea, Clazomenae, Erythrae, Teos, Lebedos, Colophon, Ephesus, Priene, Myus, Miletus, and the island cities of Chios and Samos. The 12 city states—with the later addition of Smyrna—formed a loose religious league, although they retained their individual political autonomy.

A brilliant culture flourished very early in the Ionian cities, and this was widely disseminated by the energetic Ionians, who traveled about the ancient world to trade and establish daughter colonies along the shores of the western Mediterranean and the Black Sea. The Ionian schools of philosophy, art, poetry, and literature were of great significance in the later development of Athenian culture.

In the 7th century B.C., Ionia was invaded by the Cimmerians, and later by the Lydians. The cities were finally subjected by King Croesus (r. 560-546 B.C.) of Lydia, and about 547 B.C. they fell to Cyrus the Great of Persia. In the struggle to regain their freedom the cities became involved in the wars of Persia and Greece and finally fell to Alexander III the Great (r. 336-323 B.C.) of Macedon. Under the domination of Rome and Byzantium they remained culturally significant, but with their conquest by the Turks in the 11th century they fell into decline.

IONIA, city, Michigan, seat of Ionia County, situated on the Grand River, 33 miles east of Grand Rapids, at an altitude of 650 feet. It is served by the Grand Trunk and the Chesapeake and Ohio railroads, a county airport, and state and federal highways. Ionia is the trading center for an area growing wheat, apples, and livestock; the city has flour mills and meat-packing plants, and among the varied goods produced by its factories are reed furniture, pottery, machinery, edged tools, automobile bodies, tile, and clothing. The Michigan State Reformatory and the Ionia State Hospital for the criminally insane are located here.

Settled in 1833, Ionia was incorporated as a village in 1865 and as a city in 1873. Its charter was revised in 1897 and 1924, and the city is governed by a mayor and council. Pop. 6,754.

IONIAN ISLANDS, i-ō'nī-ān, island group, Greece, in the Ionian Sea, off the southwest coast of Albania, west and south of the Greek mainland and the Peloponnesus. From north to south the seven principal islands are: Corfu (Kérkyra); Paxos (Paxoi), including Antipaxos; Leukas (Lévkás); Cephalonia (Kephallénia); Ithaca (Ithákē); Zante (Zakynthos); and Kýthēra (Cérigo), including Antikýthēra. Kýthēra and its dependency are under the Nome of Attica; the remaining islands are divided into the four nomes of Corfu, Leukas, Cephalonia, and Zante, with a total area of 751 square miles. Although each island has its individual character, all are mountainous and lack sufficient arable land to produce the grain required to support the population. The climate is mild, and rainfall, especially high in Corfu, averages about 50 inches a year. The principal crops are olives, grapes, and currants; these, together with wine and olive oil, are shipped to the mainland and to foreign countries.

Some livestock is raised, and there is local fishing. Industry is generally undeveloped.

The islands often figured individually in the history of ancient and medieval Greece. They became part of the Byzantine Empire in 330 A.D., when the capital of the Roman Empire was moved to Byzantium (Constantinople). Corfu was captured by the Norman adventurer Robert Guiscard in 1081, retaken by Manuel I Comnenus in 1149, and acquired by Venice in 1386; from the 15th century on, the other islands also became Venetian dependencies. In 1797, under the Treaty of Campoformio, they were ceded to France, but were taken by Russia in 1798-1799. From 1800 to 1807 they formed the Septinsular Republic under Ottoman sovereignty and Russian protection.

After an eight-year period of renewed French rule, the islands became a British protectorate under the Treaty of Paris (Nov. 9, 1815), and were called the United States of the Ionian Islands. Governed by a British high commissioner, they were granted a constitution (1817), which provided for a senate and a legislative assembly whose decisions were subject to the commissioner's veto. Until 1864, when Greece took over the islands, nine high commissioners ruled the protectorate. During this period the island developed politically and socially: public works were constructed, trade was encouraged, and the first Greek university was set up when Frederick North, 5th earl of Guilford, founded the Ionian Academy in 1824. A school of modern Greek poets flourished, with Dionysios Solomos (1798-1857) and Aristotelis Valaoritis (1824-1879) as its outstanding representatives.

The emergence of an independent Greece in 1830 created tension between the Greeks in the islands and the British authorities, and the French revolution of 1848 sparked riots in Cephalonia and a call for union with Greece. The following year constitutional reforms were introduced, including direct election of representatives to the legislature, but the struggle for union continued. Finally, during the search for a successor to King Otto I, who had been ousted from the Greek throne in 1862, the British government decided to cede the islands to Greece. The treaty of July 13, 1863, providing for the accession of George I to the Greek throne, included a provision for the union of the islands to the motherland. On August 1, Austria, Russia, and France consented to this revision of the treaty of 1815, and on October 5 the newly elected Ionian Assembly voted for union with but three dissenting voices. By a three-power treaty of Nov. 14, 1863, the islands were neutralized in perpetuity, and on June 2, 1864, Greece took possession. See also separate articles on individual islands. Pop. (1951) including K  th  ra, 236,119.

STEPHEN G. XYDIS,
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IONIAN SCHOOL OF PHILOSOPHY, the earliest group of Greek philosophers, antedating Socrates and hailing from the Ionian cities of Asia Minor. Thales, Anaximander, and Anaximenes, all of Miletus, and Heraclitus of Ephesus, were important early members of the group; Pythagoras, Anaxagoras, and Leucippus also came from Ionia. See also articles on the individual philosophers; **PHILOSOPHY**, **HISTORY OF**.

IONIAN SEA, a northern extension of the Mediterranean Sea, lying between the west coast

of Greece on the east and the southeast coast of Italy and the east coast of Sicily on the west. It connects with the Adriatic Sea by the Strait of Otranto and with the Tyrrhenian Sea by the Strait of Messina. To the northwest it forms the gulfs of Squillace and Taranto, and in its eastern waters off the coast of Greece are the Ionian Islands. Its chief ports include Syracuse in Sicily, Corfu and Patras in Greece, and Taranto in Italy.

IONIC ORDER, i-  n'  k, in architecture, the second of the three Greek orders (see **ORDERS OF ARCHITECTURE**), probably taking its name from the district of Ionia in Asia Minor. It may have sources in Phoenician (the lotus motif) or Assyrian (the honeysuckle) styles, but the question is unimportant, since its chief significance is as a Greek form of expression.

The Ionic column is characteristically 9 diameters high (as against 8 for the Doric and 10 for the Corinthian). The most important feature is the capital, which is rectangular and ends in large double scrolls or volutes (usually carved from separate blocks), with a palmette springing from the return of the volute upon itself, like a leaf or husk. The base is often a plinth carrying two rounded protruding forms separated by a hollow molding. In the entablature, the architrave is decorated with two or three bands, each wider and further out than the one beneath; the frieze is plain, and the cornice is distinguished by a dentil band, all as opposed to the Doric order (q.v.).

The flutings of Ionic columns may vary from none to 14, 18, 20, or, according to the Roman architect Marcus Vitruvius Pollio, 24 in number, and are generally semicircular in shape, although the flutings at the Propylaea and the Erechtheum in Athens are elliptical.

The history of the Ionic order in the ancient world shows a development from a flaring to a more refined ideal among the classical Greeks; then, with the Hellenistic period, comes a larger, more imposing scale. These tendencies were further pursued by the Romans, at whose hands the volutes became smaller and the details generally coarser and heavier, as is usual with Roman adaptations of Greek forms.

Among Greek styles, the Ionic stands between the Doric and the Corinthian. The Doric is a pure expression of structural power, bearing overtones—though never representations—of the human figure, with trunk (shaft) and head (capital), all abstract, compact, and swelling with a muscular sense of weight and counterthrust. The Ionic, being more attenuated, dissipates this force, and the capital with its volutes suggestive of horns (as on a ram), scrolls, or leaves (as in vegetation) carries a swinging ornamental effect, though still embodying a feeling of curling with the weight of the architrave. The Corinthian order (q.v.) in turn becomes more attenuated and its capital more decoratively suggestive of foliage, thus more pictorial and less architectural.

The intercolumniation, which in the Doric remained compact and strictly measured to the diameter of the column, in the Ionic and Corinthian becomes wider and loses its positive shape, leaving the columns alone in vapid space. In the later orders the details, addenda, and execution become far more articulated and refined, but the strong feeling of structural symbolism is largely lost.

The Ionic is a self-conscious style, standing on its own elaborated pedestal, as opposed to the Doric, which like the Gothic style in western European development seems naturally to grow out of the ground. In this sense Ionic may be compared with Renaissance-baroque architecture. Yet, just as the Gothic and baroque styles could be successfully combined (as in the Church of St. Lorenz at Nürnberg, Germany) because of the continuity of their formal character, so Doric and Ionic were not infrequently combined in the same building, as in the Propylaea, a Doric building with Ionic inner columns.

Outstanding examples of the Ionic order were the Erechtheum and the temples of Athena Polias and Athena Nike in Athens, the Temple of Apollo at Bassae (Phigalia), the rebuilt temple at Ephesus, and the Temple of Fortuna Virilis in Rome. See also COLUMN.

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IONOSPHERICS, ĭ-ŏn-ô-sfēr'ĭks, the scientific study of the electrically charged region of the earth's atmosphere which lies above the stratosphere (and chemosphere) and because of its composition of free electrons and positive ions is known as the *ionosphere*. The lower boundary of this atmospheric region is at an altitude of approximately 50 miles. The upper boundary has been set by various investigators at 250 to 500 miles or higher, and merges into the exosphere. (See ATMOSPHERE—*Divisions of the Atmosphere*.)

Within the ionosphere, the minute electrically charged particles known as ions are concentrated in belts or layers, and are created principally by the ionizing effects of streams of ultraviolet radiation and X-rays from the sun. The presence of the sun in the sky is a governing factor affecting both the degree of ionization and electron density of the several ionic layers. These quantities may, accordingly, vary with the time of day, the latitude, and season of the year.

The so-called *D ionic region*, which occurs just below 50 miles during the day, forms the base of the ionosphere. The superadjacent layer, called the *E ionic layer* or Kennelly-Heaviside layer, lies during daylight hours between approximately 60 and 80 miles. A transient or *sporadic E layer* also exists occasionally at about 70 miles, and is independent of solar influences. The next higher stratum, the *F ionic layer* (often called the Appleton layer after its discoverer, Edward V. Appleton) is found at night at an altitude of approximately 150 miles. During the daylight hours, it splits into two layers. The lower of these is termed the *F₁ ionic layer* and occupies a belt between approximately 110 and 140 miles; the other, the *F₂ ionic layer*, normally exists between 180 and 200 miles. The *G ionic layer* is found less frequently at heights above 400 miles and only in the vicinity of the equator.

The various ionic layers act in a fashion similar to layers of unequal optical density in refracting (see REFRACTION) radio waves which pass through them. Radio sky waves are bent and recurved until eventually they are directed back toward the earth's surface again. Broadcast-frequency radio waves (500–1500 kilocycles per second) are refracted back by the lower E layer. High-frequency or short-wave radio signals (3–30 megacycles per second) penetrate to the higher

F₁ or F₂ layers before being recurved earthward, and their energy is not as fully absorbed. With the lifting of the ionic layers at night, distance reception also usually improves.

The ionosphere is markedly influenced by electric storms in the earth's high atmosphere caused by pronounced sunspot activity, solar flares, and chromospheric eruptions on the sun, which when active may severely disrupt short-wave radio communication, telegraph, telephone, and cablegraph service. Systematic governmental radio-propagation surveys are now maintained to forecast ionospheric storms and avoid such signal disruptions.

See also RADIO—1, *Nature of Radio Communication* (The Ionosphere); SUN—*Corpuscular, Ultraviolet, and X-ray Radiation*; TERRESTRIAL MAGNETISM.

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IORGA, yŏr'gă, Nicolae, Rumanian statesman and scholar; b. Botoșani, Moldavia, Rumania, June 17, 1871; d. near Bucharest, Nov. 28, 1940. As a young student in Iași, he became interested in the development of a Rumanian national literature with the folk traditions of the Rumanian peasant as its inspiration. After studying in France and Germany (1890–1894), he returned to Rumania and became professor of world history at the University of Bucharest. In this post and as editor (1903–1906) of the periodical *Samănătorul* (*The Sower*), Iorga exerted great influence in fostering the growth of a native spirit in Rumanian literature. During these years he also brought out five volumes (1901–1909) of Rumanian literary history, which he brought up to date in 1934 with two volumes on modern literature.

Iorga's political career began in 1906 when he helped found the National Democratic Party, and in 1907 he became a deputy in the Rumanian Parliament, in which he served continuously from 1918 until his death. After World War I he was president of the national assembly which achieved the union of Bucovina, Transylvania, and Bessarabia with Rumania. From 1931 to 1932 he was minister of education and prime minister of the coalition government established by King Carol II. He was assassinated by troops of the Iron Guard shortly after the Germans occupied the country in World War II.

The list of Iorga's writings contains nearly 2,000 titles, including plays, stories, translations, and editions of historical documents. His major writing, in the field of history, includes such works as *Geschichte des rumänischen Volkes* . . . (2 vols., 1905); *Geschichte des osmanischen Reiches* (5 vols., 1908–13); *Notes et extraits pour servir à l'histoire des croisades* . . . (6 vols., 1899–1916); and *Essai de synthèse de l'histoire de l'humanité* (4 vols., 1926–28). He also published *My American Lectures* (1932).

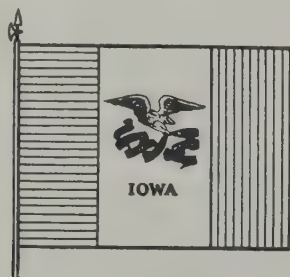
IOS, ĭŏs, Gr. ēŏs, or **NIO**, nyē'ô, island, Greece, in the Cyclades group in the Aegean Sea, approximately 13 miles southwest of the island of Naxos. It is about 12 miles long and five miles wide, with a total area of about 45 miles. The principal occupations are the cultivation of cotton, barley, and olives. Olive oil and wine are produced. Ios is one of the many places mentioned in legend as the birthplace (and burial place) of Homer.

IOSHKAR-OLA, yôsh-kâr' ŭ-lá', city, USSR, capital of the Mari Autonomous Soviet Socialist Republic, a division of the Russian Soviet Federated Socialist Republic. Ioshkar-Ola is situated on the Malaya (Little) Kokshaga River, a left tributary of the Volga, and 75 miles northwest of Kazan, with which it is linked by a railroad. Ioshkar-Ola is situated at the boundary between the northern timber area of the Mari Republic and the agricultural south, and thus combines wood and farm-processing industries. The city also has developed manufacturing industries, producing electrical instruments, movie projectors, weighing scales and vitamins. Ioshkar-Ola is the focus of roads serving the Mari Republic. The city has timber-engineering and teachers' colleges and is the seat for Mari cultural institutions. Founded in 1584, the town was known as Tsarevokokshaik in czarist times. Under the Soviet regime, its population increased rapidly, rising from 4,374 in 1926 to 89,000 in 1959.

I.O.U., in law, is an informal acknowledgment of indebtedness. It is distinguishable from a promissory note, which consists of an express promise to pay a definite sum of money, by containing merely an implied promise to pay. By the weight of judicial authority, an I.O.U. is enforceable in the courts. The legislatures of some states have similarly extended the law of bills and notes to include any written instrument whereby any person acknowledges a sum of money to be due to another person. An I.O.U. has been defined as a written memorandum of debt, consisting of these three letters, a statement of the amount, and the debtor's signature. Even though an I.O.U. may be adequate, with respect to form, to constitute a valid acknowledgment of debt, recovery in court may be denied in particular cases for reasons relating to the nature of the underlying transaction. For example, an I.O.U. given for a gambling debt might be unenforceable for reasons of public policy. Also, of course, the instrument must be based on a legally sufficient consideration in order to constitute a valid promise to pay.

RICHARD L. HIRSHBERG.

IOWA, í'ô-wà, a Middlewestern state of the United States, situated between the Mississippi River on the east and the Missouri and Big Sioux rivers on the west. The state is bounded by Minnesota on the north, by Wisconsin and Illinois on the east, by Missouri on the south, and by



State flag

Nebraska and South Dakota on the west. It is roughly 300 miles from the east to the west boundary, and 200 miles from north to south.

The meaning of the Indian word *Iowa* is not definitely known, although several possible translations, including "beautiful land," "this is the place," and "one who puts to sleep," have been offered.

Total area	56,290 square miles
Land area	56,045 square miles
Water area	245 square miles
Latitude	40° 24' to 43° 30' N.
Longitude	90° 5' to 96° 40' W.
Altitude (average)	1,100 feet
High point, Ocheyedan Mound	1,675 feet
Low point, Mississippi River	480 feet
Population, 1960	2,757,537
Capital—Des Moines; population	208,982
Admitted to Union as 29th state	Dec. 28, 1846
State motto	<i>Our Liberties We Prize and Our Rights We Will Maintain</i>
(adopted Feb. 25, 1847)	
State bird (adopted March 22, 1933)	Eastern goldfinch
State flower (adopted May 7, 1897)	Wild rose
State tree (adopted 1961)	Oak
State song (adopted March 20, 1911)	<i>Iowa</i>
State nickname	Hawkeye State



State seal

Iowa has long been one of the leading agricultural states in the nation. Early settlers found the soil and climate favorable for bountiful harvests of food and feed grains. Wise farming practices and the acceptance of modern agricultural technology, including mechanization, have resulted in increased production and an exceptionally high standard of living for farmers, but have also brought about a numerical decrease in the agricultural population, part of the surplus of which has found employment in manufacturing plants. Since 1950, the value of manufactured goods has come to rival and even exceed that of raw agricultural produce, although the state still contributes about one tenth of the national food supply. During the two decades after 1940, more persons moved out of Iowa than moved into it, but the total population continued to rise because of natural increase.

A discussion of Iowa's geography, government, social and economic life, and history is presented under the following headings:

1. Physical Features
2. Population and Political Divisions
3. Government
4. Education, Health, and Welfare
5. Economic Activities
6. Transportation and Communications
7. Cultural Life
8. Places of Interest
9. Famous Men and Women
10. History
11. Bibliography

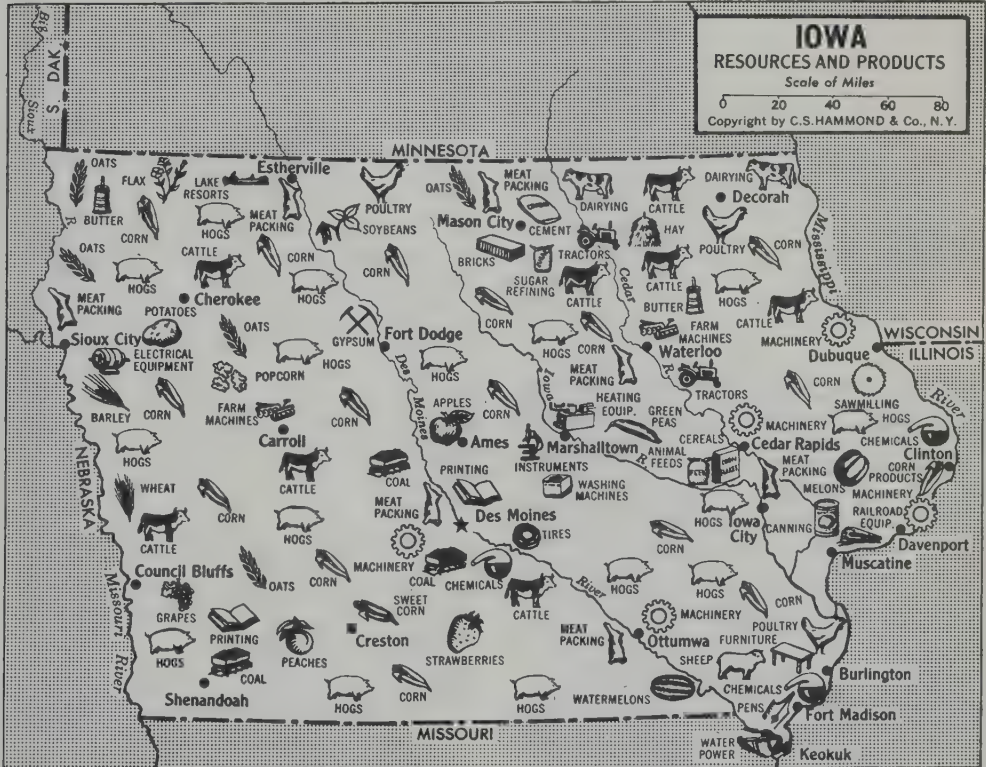
1. PHYSICAL FEATURES

Most of the surface of Iowa is a glacial plain that slopes from the northwest to the southeast, from Ocheyedan Mound in Osceola County, the highest point (1,675 feet), to the mouth of the Des Moines River in Lee County (480 feet). Approximately two thirds of the state is between 800 and 1,400 feet above sea level.

Topography.—The watershed runs from the northwest part of the state to the southeast. About two thirds of the total area drains into the Mississippi River by way of the Upper Iowa, Turkey, Wapsipinicon, Cedar, Iowa, Skunk, Racoon, and Des Moines rivers. The western part of the state drains into the Missouri River through such streams as the Rock, Little Sioux, Boyer, and Nishnabotna. The south central part of Iowa is drained by the Nodaway, Thompson, and Chariton rivers through northern Missouri and into the Missouri River.

Glacial drift formed a number of small lakes in the northwest. Lake Okoboji, Spirit Lake, and Clear Lake are the largest of the 13 natural lakes in Iowa. There are also several artificial lakes, supervised by the State Conservation Commission.

Climate.—Iowa's climate is the humid, continental, long-summer type. In winter, cold air masses from northwestern Canada sweep across the state, bringing below-zero temperatures; summer temperatures are high, showing the effect of continentality. Average January temperature at Des Moines, which is centrally located in the



The oldest outcrop of rock, Proterozoic, is found in the northwestern corner of the state. In northeast Iowa, Cambrian and Ordovician rocks outcrop in high bluffs along the Mississippi River. Because of the rugged topography and the presence of a dairy economy, this section has been called the "Little Switzerland" of Iowa.

Evidence of five different glaciers can be found in Iowa. The deposits left by each glacier range from 10 to 150 feet in depth; this glacial deposit was the parent material for soil formation. A correlation between the economic life of the state and this prehistoric influence can be illustrated with almost mathematical exactness by superimposing a 20th century resources map on a glacial map of the state. The last invasion of glacial ice (the Wisconsin, estimated to have occurred about 10,000 to 12,000 years ago) covered about 20 per cent of the state and was especially beneficial to what are now the north central counties. In this area the soil is especially rich and the land is relatively level and poorly drained.

state, is 22.8° F.; the July average is 77.1° F.

Frequent cyclonic storms are associated with winter precipitation, usually in the form of snow, which averages about 30 inches per year. The summer maximum precipitation is mainly from convectonal thundershowers which permit a high percentage of sunshine during the growing season. Annual rainfall is also around 30 inches a year and is dependable; seldom is precipitation so low that crop failure occurs. The growing season lasts from early May to the first part of October. Northwest Iowa usually has 140 frost-free days a year, southern Iowa nearly 170 days frost-free. The average length of the growing season is 156 days. Hailstorms and tornadoes, the latter occurring usually in May and June, are the most destructive types of summer storms. Infrequent blizzards in winter are less destructive now than in the past, since their arrival is predicted.

Native Vegetation.—Two types of native vegetation existed in Iowa before the white man arrived. The oak-hickory forest, together with

some ash, black walnut, elm, and box elder grew along most of the streams and covered about one fifth of the present state. Prairie grassland was found between the rivers, covering a much larger percentage of the land. Tall, luxuriant, and relatively deep-rooted grasses, principally bluestem, bunch grass, and Indian grass, were mixed with a large variety of herbaceous flowering plants. In the early spring, phloxes, shooting stars, and spiderworts added variety and color to the landscape. The original prairie grassland can now be seen in only a few places. Three prairie grass preserves are supervised by the State Conservation Commission.

Animal Life.—The early settlers found the Iowa prairie and forests full of game and the rivers well stocked with fish. Muskrat, raccoon, skunk, rabbit, and gopher are still common. The white-tailed or Virginia deer is increasing, and there is a short deer-hunting season each year. Poultry raisers still find the red fox a predator. Small birds that either live in or migrate through the state by means of the Mississippi-Missouri flyways include the cedar waxwing, cardinal, junco, thrush, sparrow, starling, Eastern goldfinch, chickadee, blackbird, robin, and woodpecker. The ring-necked pheasant was imported and is now a major game bird. Prairie chicken, wild turkey, and wild pigeon have disappeared. Hawks and owls are the chief predatory birds.

A variety of fish in the rivers and lakes offer limited commercial possibilities, as well as recreation for sportsmen. Among the common types are catfish, bullhead, carp, walleyed pike, bluegill, perch, smallmouthed bass, and trout.

Conservation.—Iowa's most valuable natural resource is soil, and considerable attention is given to conservation practices. About 46 per cent of the state is classified as "soil erosion unimportant," but in another 45 per cent sheet erosion is moderate with considerable gullying locally, and in the remaining 9 per cent of the state there is severe sheet erosion with moderate to severe gullying. Numerous conservation practices are utilized, such as terracing, contour farming (about 35 per cent of the cropland is contoured), permanent sod waterways (more common than in any other state of the nation), drainage (in the north central section of the state), and dams, built principally for erosion control.

Water conservation has received much attention in recent years because of increasing demands for this resource by industry, municipalities, and agriculture. Annual runoff is estimated to be about 20 per cent of the yearly precipitation. Iowa is in the process of establishing a definite water policy, and the State Natural Resources Board has conducted watershed studies and programs for the larger and some of the smaller streams. Thousands of farm ponds or tanks have been constructed, most of which are in southern Iowa, where some cities depended partially or entirely on artificial reservoirs for their water supplies.

2. POPULATION AND POLITICAL DIVISIONS

Population Characteristics.—Early settlers of Iowa came from the eastern and southern areas of the United States. Immigrants from northern Europe were attracted to available Iowa farms in the mid- and late 19th century. German, Scandinavian, and Irish communities were especially evident; Dutch, Bohemian, French, and

other national groups came in smaller numbers. Some communities continue to have bilingual residents although, by 1960, less than 1.5 per cent of the state's white population was foreign born. Some Negroes migrated north to Iowa during the Civil War, and 20th century industrial development attracted Negroes to the larger cities. In 1950 the Iowa population of 2,621,073 represented an increase of 3.3 per cent over the 1940 census figure, and the 1960 total of 2,757,537 was up 5.2 per cent from 1950, but these gains were far below the national average. Density of population averaged 49.2 per square mile in 1960, and 47 per cent of the state's citizens resided in areas classified as rural.

Political Divisions.—Local government areas created by state authority comprise counties, townships, school districts, and towns and cities.

Cities and Towns.—A town may be incorporated when at least 25 voters favor the action. In the 1960 census, there were 20 cities having a population of at least 15,000, and 108 with populations between 2,000 and 15,000. Towns are classified as those communities with populations under 2,000; there were over 800 such incorporated places. Davenport, Muscatine, Wapello, and Comanche have special charters granted before the adoption of the constitution of 1857. Cities of more than 15,000 population in 1960 were:

Des Moines	208,982	Burlington	32,430
Cedar Rapids	92,035	Mason City	30,642
Sioux City	89,159	Fort Dodge	28,399
Davenport	88,981	Ames	27,003
Waterloo	71,755	Marshalltown	22,521
Dubuque	56,606	Cedar Falls	21,195
Council Bluffs	54,361	Muscatine	20,997
Ottumwa	33,871	Keokuk	16,316
Clinton	33,589	Newton	15,381
Iowa City	33,443	Fort Madison	15,247

Townships.—Townships continue to be geographical and political units in Iowa, but they have diminishing powers. Township trustees and clerks are elected, and some townships continue to elect constables and justices of the peace.

School Districts.—School districts receive their powers from the Iowa General Assembly. District reorganization was accelerated in the 1950's by a requirement that all land must be in a district that operates a four-year high school.

Counties.—There are 99 counties in Iowa, ranging in population from Polk with 266,315 in 1960 to Adams with 7,468. Kossuth is the largest, with an area of 979 square miles, and Dickinson the smallest, with 382 square miles. Voters elect the following county officers: supervisors, sheriff, attorney, coroner, auditor, recorder, clerk of court, and treasurer. A list of the counties and their county seats follows:

COUNTY	COUNTY SEAT	COUNTY	COUNTY SEAT
Adair	Greenfield	Clarke	Osceola
Adams	Corning	Clay	Spencer
Allamakee	Waukon	Clayton	Elkader
Appanoose	Centerville	Clinton	Clinton
Audubon	Audubon	Crawford	Denison
Benton	Vinton	Dallas	Adel
Black Hawk	Waterloo	Davis	Bloomfield
Boone	Boone	Decatur	Leon
Bremer	Waverly	Delaware	Manchester
Buchanan	Independence	Des Moines	Burlington
Buena Vista	Storm Lake	Dickinson	Spirit Lake
Butler	Allison	Dubuque	Dubuque
Calhoun	Rockwell City	Emmett	Estherville
Carroll	Carroll	Fayette	West Union
Cass	Atlantic	Floyd	Charles City
Cedar	Tipton	Franklin	Hampton
Cerro Gordo	Mason City	Fremont	Sidney
Cherokee	Cherokee	Greene	Jefferson
Chickasaw	New Hampton	Grundy	Grundy Center

Guthrie	Guthrie Center	Muscatine	Muscatine	Joshua G. Newbold	Republican	1877-1878
Hamilton	Webster City	O'Brien	Primghar	John H. Gear	"	1878-1882
Hancock	Garner	Osceola	Sibley	Buren R. Sherman	"	1882-1886
Hardin	Eldora	Page	Clarinda	William Larrabee	"	1886-1890
Harrison	Logan	Palo Alto	Emmetsburg	Horace Boies	Democrat	1890-1894
Henry	Mount Pleasant	Plymouth	Le Mars	Frank Darr Jackson	Republican	1894-1896
Howard	Cresco	Pocahontas	Pocahontas	Francis M. Drake	"	1896-1898
Humboldt	Dakota City	Polk	Des Moines	Leslie M. Shaw	"	1898-1902
Ia	Ida Grove	Pottawattamie	Council Bluffs	Albert B. Cummins	"	1902-1908
Iowa	Marengo	Poweshiek	Montezuma	Warren Garst	"	1908-1909
Jackson	Maquoketa	Ringgold	Mount Ayr	Beryl F. Carroll	"	1909-1913
Jasper	Newton	Sac	Sac City	George W. Clarke	"	1913-1917
Jefferson	Fairfield	Scott	Davenport	William L. Harding	"	1917-1921
Johnson	Iowa City	Shelby	Harlan	Nathan E. Kendall	"	1921-1925
Jones	Anamosa	Sioux	Orange City	John Hammill	"	1925-1929
Keokuk	Sigourney	Story	Nevada	Daniel W. Turner	"	1929-1933
Kossuth	Algona	Tama	Toledo	Clyde L. Herring	Democrat	1933-1937
Lee	{ Keokuk	Taylor	Bedford	Neelson G. Kraschel	"	1937-1939
Linn	{ Fort Madison	Union	Creston	George A. Wilson	Republican	1939-1943
Louisa	Cedar Rapids	Van Buren	Keosauqua	Bourke B. Hicklenlooper	"	1943-1945
Lucas	Wapello	Wapello	Ottumwa	Robert D. Blue	"	1945-1949
Lyon	Chariton	Warren	Indianola	William S. Beardsley	"	1949-1954
Madison	Rock Rapids	Washington	Washington	Leo Elthon	"	1954-1955
Mahaska	Winterset	Wayne	Corydon	Leo A. Hoegh	"	1955-1957
Marion	Oskaloosa	Webster	Fort Dodge	Herschel C. Loveless	Democrat	1957-1961
Marshall	Knoxville	Winnebago	Forest City	Norman A. Erbe	Republican	1961-1963
Mills	Marshalltown	Winneshiek	Decorah	Harold E. Hughes	Democrat	1963-
Mitchell	Glenwood	Woodbury	Sioux City			
Monona	Osage	Worth	Northwood			
Monroe	Onawa	Wright	Clarion			
Montgomery	Red Oak					

3. GOVERNMENT

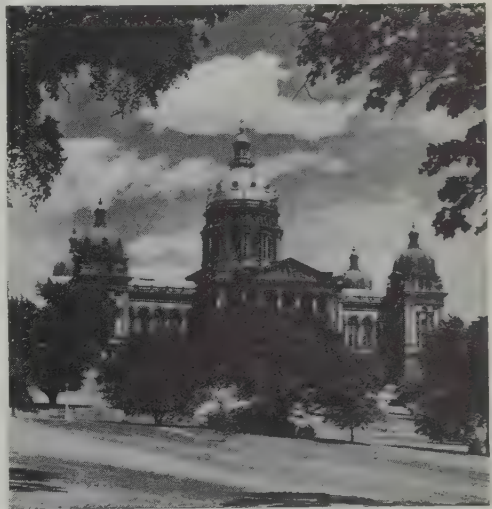
State Constitution.—Iowa became a state in 1846, and its first constitution remained in effect until the adoption of the present constitution in 1857. Twenty-one amendments had been added to the latter by 1964. A majority vote of two successive legislatures and a majority vote of the people is required to amend the constitution. The General Assembly is also instructed in the constitution to submit, after each federal census, the following question to qualified voters: "Shall there be a convention to revise the constitution, and amend the same?" A bill of rights is provided for, as well as the basic structure of government and a definition of its powers and limitations. Voters are required to be United States citizens at least 21 years old, and to have resided in Iowa for at least six months and in the county for at least 60 days.

Iowa has 7 members in the U.S. House of Representatives and 2 United States Senators.

Executive.—The governor, lieutenant governor, secretary of state, attorney general, treasurer, auditor, and secretary of agriculture are elected for two-year terms. These officials, with the exception of the lieutenant governor and the attorney general, form the state Executive Council. The governor is aided by an administrative assistant and the state comptroller. There are numerous commissions, boards, and agencies to supervise public schools, institutions of higher learning, health, social welfare, penal and mental health institutions, public safety, highways, aeronautics, industry, banking, insurance, labor, and personnel.

GOVERNORS OF IOWA

TERRITORIAL		
Robert Lucas		1838-1841
John Chambers		1841-1845
James Clark		1845-1846
STATE		
Ansel Briggs	Democrat	1846-1850
Stephen Hempstead	"	1850-1854
James Wilson Grimes	Whig and Free Soil Democrat	1854-1858
Ralph P. Lowe	Republican	1858-1860
Samuel J. Kirkwood	"	1860-1864
William M. Stone	"	1864-1868
Samuel Merrill	"	1868-1872
Cyrus C. Carpenter	"	1872-1876
Samuel J. Kirkwood	"	1876-1877



Iowa Development Commission

The state capitol at Des Moines.

representative, and the nine most populous counties elect two. There are 50 senators, each elected for four years. The constitution calls for Senate redistricting after each federal census, but this was not done for 50 years and by 1960 district populations varied from 20,000 to 200,000. An amendment reapportioning the legislature received a first Assembly passage in 1961, and a second Assembly passage in 1963. It would create 58 Senate districts, based on population, and 99 House districts, one for each county.

Judiciary.—The Iowa Supreme Court is composed of nine justices, who are elected for six-year terms. Iowa counties are organized into 21

district courts, which have extensive jurisdiction over civil and criminal cases. The 71 District Court judges serve four-year terms. A constitutional amendment making Supreme Court and District Court judgeships appointive instead of elective won final approval by the electorate in the 1962 primary. Cities and towns have superior or municipal courts, and some townships still elect justices of the peace for two-year terms.

Taxation.—The Iowa budget is prepared by the comptroller with the approval of the governor and is adopted or modified by action of the state legislature. The State Tax Commission administers taxes on beer, chain stores, cigarettes, inheritances, insurance companies, corporation income, individual income, and sales and use taxes. The State Safety Department collects fees relating to the use of automobiles. The state treasurer collects gasoline taxes. Since 1933, property tax has been used principally to support local areas of government. The largest annual income is derived from the sales, gasoline, and individual income taxes.

4. EDUCATION, HEALTH, AND WELFARE

Public Schools.—At mid-century, Iowa led the nation in its small percentage of illiterate residents (0.8 per cent). It has also been conspicuous as a state of numerous and small school districts. In the pioneer communities, schools were financed by rates paid by the patrons; preparatory academies were operated by churches or local communities. Public schools are now supported by

duced from 4,417 in 1954-1955 to 1,231 in 1962-1963. Voters in the community school district elect a board that employs the superintendent and teaching staff. The state superintendent of public instruction is employed by a nine-member State Board of Instruction. The state office administers state aid funds to local schools, certifies teachers, and supervises school bus transportation, help for exceptional children, vocational education, veteran training programs, the school lunch program, and all tax-supported junior colleges. The intermediate school authority on the county level enforces state law locally and gives various types of help to the local schools. Few courses are required by state law, and the local school plans much of its own program.

Higher Education.—Iowa has three institutions of higher education under the supervision of the Board of Regents: the State University of Iowa at Iowa City (founded in 1847), the Iowa State University of Science and Technology at Ames (1858), and the State College of Iowa at Cedar Falls (1876, known before 1961 as Iowa State Teachers College). The nine members of the Board of Regents are appointed for staggered six-year terms by the governor, with the consent of the Senate. A number of public junior colleges are included in the local public school system.

From territorial days, Iowa has had a strong tradition of church-supported liberal arts colleges. Those currently operating include Briar Cliff College at Sioux City, Buena Vista College at Storm Lake, Central College at Pella, Clarke College at Dubuque, Coe College at Cedar Rapids, Cornell College at Mount Vernon, Drake University at Des Moines, University of Dubuque at Dubuque, Graceland College at Lamoni, Grinnell College at Grinnell, Iowa Wesleyan College at Mount Pleasant, Loras College at Dubuque, Luther College at Decorah, Marycrest College at Davenport, Morningside College at Sioux City, Parsons College at Fairfield, St. Ambrose College at Davenport, Simpson College at Indianola, Upper Iowa University at Fayette, Wartburg College at Waverly, Westmar College at Le Mars, and William Penn College at Oskaloosa.

Libraries.—The state maintains a traveling library at Des Moines to help small libraries and to serve localities having no public libraries. Free public libraries are supported by local taxation. Public schools are expected to have at least a part-time librarian to care for the school book collection.

There are four libraries in the state where research may be profitably pursued. The library of the State University of Iowa, at Iowa City, may be expected to have all standard reference works, secondary books, and bound newspapers; in addition, it is rapidly building up its collections of manuscripts. The library of the State Historical Society of Iowa, also at Iowa City, is rich in materials for the study of the state's history. The Iowa State University library at Ames is especially good for research in government publications having to do with engineering, atomic energy, and all phases of agriculture. The library of the Iowa State Department of History and Archives at Des Moines has a fine collection of official state publications as well as the state government's archival deposits. At least four of its manuscript collections are worthy of notice: the William Boyd Allison papers, the Grenville M. Dodge papers, the Albert B. Cummins papers, and the Emerson Hough papers.



A. Devaney

Students cross the campus of the State University of Iowa, at Iowa City. The school was founded in 1847.

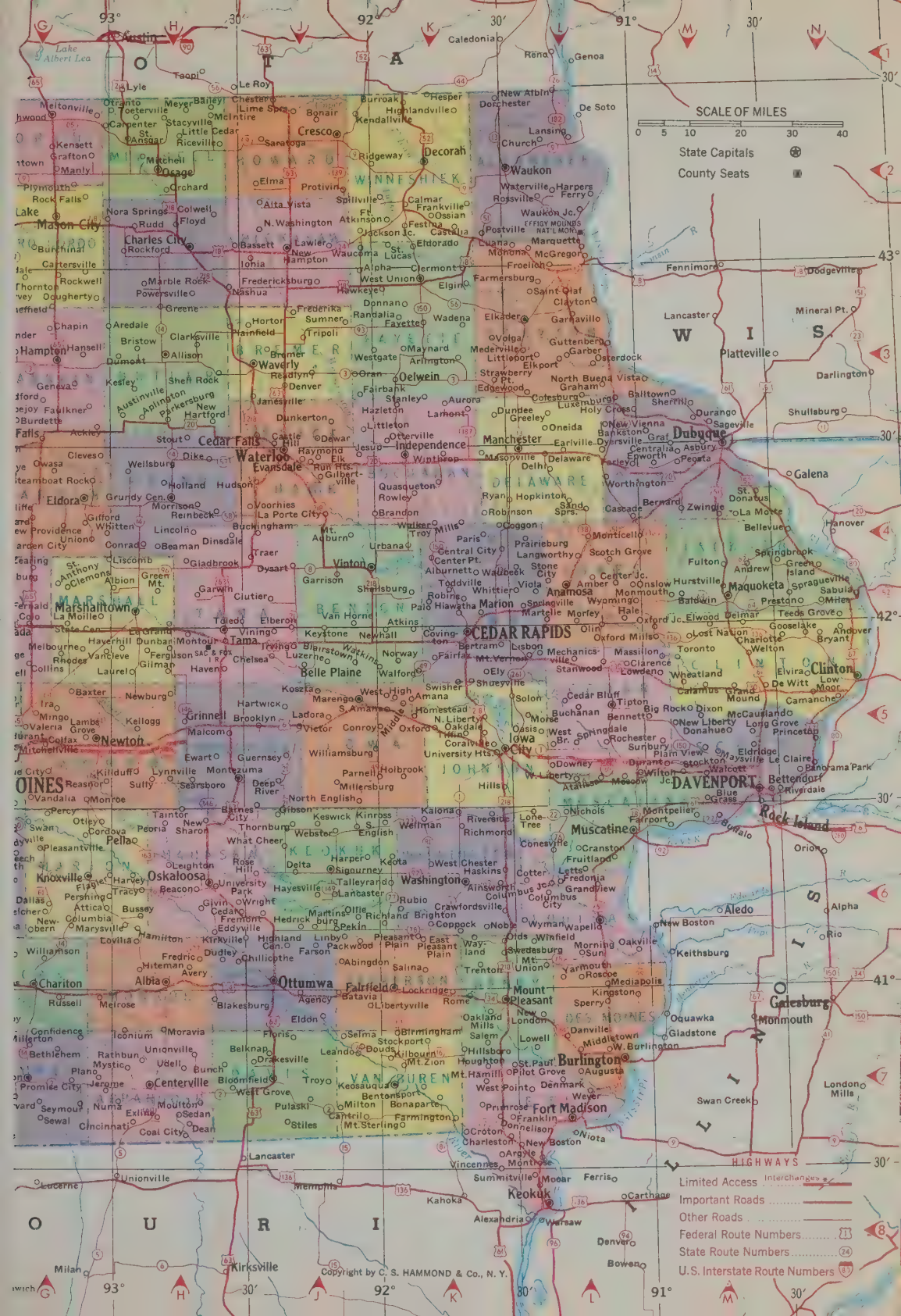
taxation and supervised by state authorities. Attendance is required through the age of 16 and a school year of at least 9 months is mandatory.

Inadequate variety in the curriculum offered by small schools, especially at the secondary level, has led since the mid-1950's to the combining of many rural and urban districts into larger community districts with greater school populations. Thus the total number of school districts was re-

1960 Final Census 2,757,537; 1965 Est. 2,760,000

All figures available from 1960 final census are supplemented by local official estimates.





1960 Final Census 2,757,537; 1965 Est. 2,760,000

La Porte City (J4)	1,953	Melch (G6)	867	Palo (K4)	387	Scranton (D4)	865	Walford (K5)	264
Ladonia (G6)	396	Melrose (G7)	210	Panama (B5)	257	Seaboard (H5)	165	Walker (K4)	584
Ladora (J5)	307	Melvin (B2)	361	Panora (E5)	1,019	Sergeant Bluff (A4)	813	Wall Lake (C4)	812
Lake City (D4)	2,114	Menlo (E5)	424	Panorama Park (N5)	140	Seymour (G7)	1,117	Wallingford (D2)	228
Lake Mills (F2)	1,758	Meriden (B3)	192	Parkersburg (H3)	1,468	Shambaugh (D7)	206	Walnut (C6)	777
Lake Park (C2)	952	Merrill (A3)	645	Parnell (U5)	200	Shannon City (E7)	127	Wapello (L6)	1,745
Lake View (C4)	1,165	Meservy (G3)	331	Parot (E4)	207	Sharpsburg (D7)	130	Washington (K6)	5,037
La Grange (G6)	306	Mickleton (L7)	245	Paterson (F5)	157	Sheldon (F5)	150	Washington (K6)	5,037
Lakota (E2)	439	Miles (N4)	367	Paulina (B5)	1,329	Shelby (C5)	533	Waterloo (J4)	71,755
Lamb Grove (G5)	234	Millard (C2)	1,476	Pella (H6)	5,198	Sheldahl (F5)	279	Waterloo (urban area)	102,827
Lamoni (E7)	2,173	Millersburg (J5)	186	Pestola (M4)	50	Sheldon (B2)	4,251	Waterville (L2)	184
Lamont (K3)	554	Millerton (G7)	90	Perry (E5)	6,442	Shell Rock (K3)	1,112	Waucoma (J2)	364
Lanesboro (D4)	258	Milo (G6)	468	Persia (B5)	322	Shellsburg (K4)	625	Waukeo (F5)	687
Lansing (L2)	1,325	Milton (J7)	609	Peterson (C3)	565	Shenandoah (C7)	5,567	Waukon (L2)	657
Larchwood (A2)	331	Mimburn (E5)	351	Peter (B3)	425	Sherrill (M3)	267	Webb (D3)	596
Larson (G6)	1,633	Minden (E5)	351	Pillager (F4)	125	Shiloh (M3)	2,852	Webster City (F4)	8,520
Latimer (C3)	445	Mingo (G5)	260	Pioneer (C3)	448	Sidney (B7)	1,057	Weldon (F7)	202
Laurel (H5)	223	Missouri Valley (B5)	3,567	Pisgah (B5)	343	Sigourney (J6)	2,387	Wellman (K8)	1,085
Laurens (D3)	1,799	Mitchell (H2)	237	Plainfield (J3)	445	Silver City (B6)	281	West Branch (L5)	1,053
Lawler (J2)	532	Mitchellville (G5)	957	Plano (G7)	87	Sioux Center (A2)	2,275	West Burlington (L7)	2,560
Lawton (A4)	324	Modale (B5)	276	Pleasant Hill (F5)	397	Sioux City (A3)	89,159	West Chester (K6)	253
Le Claire (N5)	1,546	Mondamin (B5)	436	Pleasant Plain (K6)	143	Sioux City (urban area)	97,226	West Des Moines	11,949
Le Grange (G6)	465	Monmouth (H5)	103	Pleasantville (G6)	1,025	Sioux Rapids (C3)	912	West Liberty (L5)	2,042
Le Mars (A3)	6,677	Monroe (G5)	1,366	Plover (D3)	182	Slater (F5)	767	West Okoboji (C2)	171
Le Roy (F7)	70	Monroeville (H5)	1,416	Plymouth (G2)	422	Sloan (A4)	704	West Point (K7)	758
Ledyard (E2)	289	Montezuma (H5)	1,416	Pocahontas (D3)	2,011	Smithland (B4)	349	West Union (K3)	2,551
Lehigh (E4)	846	Monticello (L4)	3,190	Polk City (F5)	567	Soldier (B5)	284	Westfield (A3)	187
Leighton (H6)	167	Montour (H5)	452	Pomeroy (D3)	816	Solon (L5)	604	Westgate (K3)	214
Leona (D7)	1,178	Montrose (L7)	632	Popejoy (G3)	190	Somers (E4)	139	Westland (L5)	180
Lison (G6)	2,178	Montvay (E7)	773	Port Clinton (C3)	113	Spencer (J6)	217	Westside (C4)	643
Lester (A2)	239	Mooreland (E4)	281	Postville (C2)	1,554	Spencer (C2)	8,864	What Cheer (J6)	956
Letts (L6)	392	Moravia (H7)	621	Prairie City (G5)	943	Spillville (J2)	389	Wheatland (M5)	643
Lewis (C6)	501	Morley (L4)	124	Prairieburg (L4)	226	Spirit Lake (D2)	2,685	Whiting (A4)	595
Libertyville (K7)	368	Morning Sun (L6)	875	Prescott (D6)	331	Springville (N4)	100	Whittemore (E2)	741
Lidderdale (D4)	201	Morrison (H4)	139	Preston (N4)	819	Spring Hill (F6)	111	Whitten (H4)	184
Lime Springs (J2)	581	Moulton (H7)	773	Primgarth (B2)	1,131	Springbrook (N4)	139	Willey (D5)	80
Linden (E5)	238	Mound (A4)	106	Princeton (N5)	814	Springfield (L4)	588	William (F3)	403
Linn Grove (C3)	330	Mount Airy (E7)	1,738	Proctor (G7)	61	Stacile (H2)	139	Williamsburg (J5)	3,442
Lisbon (L5)	1,227	Mount Pleasant (L7)	7,339	Protivin (J2)	302	Stanhope (F4)	461	Williamson (G6)	262
Liscomb (H4)	295	Mount Sterling (J7)	86	Pulaski (J7)	299	Stanton (C3)	514	Wilton Junction (M5)	1,750
Little Rock (B2)	564	Mount Union (L6)	175	Quasqueton (K4)	373	Stanton (C7)	514	Windsor Heights (F5)	4,715
Little Sioux (B5)	1,177	Mount Vernon (K5)	2,593	Quincy (B3)	369	Stantonwood (L5)	598	Winfield (L6)	862
Littleton (K3)	305	Moville (A4)	1,156	Radcliffe (G4)	615	State Center (G5)	1,142	Winsteret (E5)	3,639
Livemore (E3)	545	Murray (F6)	516	Rake (F2)	328	Steamboat Rock (G4)	426	Winthrop (K4)	643
Lockridge (K7)	206	Muscatine (L6)	2,217	Randall (F4)	201	Stockton (M5)	164	Wiota (F2)	195
Logan (B5)	1,605	Mystic (H7)	731	Randall (F4)	201	Stork Lake (C3)	7,728	Woden (D6)	283
Lohrville (D4)	653	Nashua (J3)	1,767	Randolph (B7)	257	Story City (F4)	1,773	Woodbine (B5)	1,304
Lone Rock (E2)	185	Nemaha (C3)	151	Rathbun (B7)	203	Stout (H3)	145	Woodburn (F7)	202
Lone Rock (L6)	717	Neola (B6)	870	Raymond (J4)	378	Strawberry Point (K3)	1,303	Woodward (E5)	967
Long Grove (M5)	182	Nevada (G5)	4,227	Readlyn (J3)	543	Struble (C3)	224	Worthington (L4)	360
Lorimer (E6)	460	New Albion (L2)	3,456	Reed (G5)	224	Sturdy (C3)	1,486	Wyoming (L4)	797
Lost Nation (M5)	567	New Hampton (C3)	348	New Castle (G6)	6,421	Sumner (J3)	2,170	Yale (E5)	260
Loxia (H6)	630	New Liberty (M5)	145	Redding (E7)	129	Superior (D2)	190	Yetter (D4)	85
Low Moor (N5)	343	New London (L7)	1,694	Redfield (E5)	966	Sutherland (B3)	883	Yorktown (C7)	150
Lowden (L5)	641	New Market (D7)	506	Reinbeck (H4)	1,621	Swaledale (G3)	217	Zearing (F4)	528
Ly Verne (C3)	468	New Providence (G4)	206	Rembrandt (C3)	265	Swan (G7)	169	Zionville (M4)	110
Luna (D7)	276	New Sharon (H6)	1,063	Remsen (B3)	1,338	Swan (G7)	169		
Lucas (G6)	357	New Vienna (L3)	263	Renwick (C3)	477	Swisher (C2)	825		
Luther (F5)	147	New Venn (F6)	381	Riceville (H2)	898	Swisher (C2)	825		
Luxemburg (L3)	159	Newell (D3)	395	Riceville (H2)	898	Tabor (B7)	909		
Luzerne (J5)	136	Newhall (K5)	495	Richland (K6)	546	Tama (H5)	2,925		
Lynnville (H5)	411	Newton (H5)	15,381	Ricketts (B4)	133	Templeton (D5)	354		
Lytton (D4)	376	Nichols (L6)	329	Ridgeway (K2)	267	Tennant (C5)	96		
Macedonia (C6)	296	Nodaway (D7)	204	Ringsted (D2)	559	Terrill (C2)	382		
Macedonia (E8)	174	Nora Springs (H2)	1,275	Rippey (E5)	331	Thayer (E6)	101		
Madrid (F5)	2,286	North Buena Vista (L3)	176	Riversdale (M5)	414	Thorburn (E3)	234		
Magnolia (B5)	215	North English (J5)	1,004	Riverside (K6)	656	Thorn (E3)	234		
Malcom (H5)	416	North Liberty (K5)	334	Riverton (B7)	399	Thornburg (J6)	101		
Mallard (D3)	431	North Washington (J2)	156	Robins (K4)	426	Thornton (G3)	449		
Maloy (E7)	68	Northboro (C7)	135	Rock Falls (G2)	156	Thurman (B7)	268		
Malvern (B7)	1,193	Northwood (G2)	1,768	Rock Rapids (A2)	2,780	Tiffin (K5)	311		
Mancha (L3)	447	Norwalk (F6)	1,328	Rock Valley (A2)	1,693	Tingley (E7)	278		
Manilla (C5)	939	Norway (G5)	516	Rockwell (C3)	772	Tipton (E7)	2,862		
Manly (G2)	1,425	Numa (G7)	202	Rockwell (C3)	772	Tipton (E7)	2,862		
Manning (C5)	1,676	Oakland (C6)	1,340	Rockwell City (D4)	2,313	Toledo (H4)	2,850		
Manson (D3)	1,789	Oakville (L6)	346	Rodman (D2)	144	Toronto (M5)	144		
Mapleton (B4)	1,686	Ocheyedan (B2)	662	Rodney (A4)	94	Traer (J4)	1,623		
Maquoketa (M4)	5,909	Odebolt (C4)	1,331	Roland (F4)	748	Treynor (B6)	368		
Marathon (C3)	516	Delwin (K3)	8,282	Rolfe (D3)	819	Tripoli (J3)	1,179		
Marble Ridge (H3)	593	Oden (A4)	1,525	Rome (K7)	117	Truesdale (C3)	133		
Marcus (B5)	1,307	Ogden (A4)	330	Ross (J6)	117	Truro Hill (C3)	338		
Marengo (J5)	2,264	Olks (K6)	188	Rossie (C2)	102	Turin (B4)	163		
Marion (K4)	10,882	Olins (K6)	703	Rowan (F3)	273	Udell (H7)	76		
Marne (C6)	505	Olle (J6)	291	Rowley (K4)	234	Underwood (B6)	337		
Marquette (L2)	272	Onawa (A4)	3,176	Royal (C2)	475	Union (G4)	534		
Marshalltown (G4)	22,521	Onida (L3)	76	Rudd (H2)	436	Unionville (H7)	185		
Martensdale (F6)	316	Onslow (M4)	269	Runnells (G5)	322	University Heights (K5)	941		
Martinsburg (J6)	112	Oranville (A2)	247	Russell (G7)	577	University Park (H6)	569		
Marysville (G6)	173	Orchard (H2)	116	Ryan (C3)	312	Urbana (F5)	5,821		
Mason City (G2)	30,642	Orient (E5)	281	Rutland (E3)	221	Urbana (F5)	5,821		
Masonville (K4)	168	Orleans (C2)	390	Ryan (K4)	347	Ute (B4)	511		
Massena (D6)	456	Osage (H2)	3,753	Sabula (N4)	894	Vail (C4)	473		
Matlock (A2)	103	Osceola (F6)	3,350	Sac City (C4)	3,354	Valeria (G5)	76		
Maxwell (E5)	773	Oskaaloosa (H6)	11,053	Saint Ansgar (H2)	1,014	Van Hone (J4)	554		
Maynard (K3)	515	Ossian (K2)	827	Saint Anthony (G4)	130	Van Meter (E5)	385		
Maysville (M5)	126	Otsego (L3)	226	Saint Charles (F5)	363	Van Wert (F7)	253		
McCallsburg (G4)	272	Otho (E4)	593	Saint Marys (F6)	94	Varnum (D3)	162		
McCausland (M5)	173	Otto (B4)	291	Saint Olaf (L3)	169	Ventura (F5)	450		
McClelland (B6)	150	Ottosen (E3)	92	Saint Paul (L7)	128	Victor (J5)	870		
McClung (L2)	1,040	Ottumwa (J6)	33,871	Salem (K7)	442	Vilvica (C7)	1,690		
McIntire (H2)	100	Owasa (G5)	603	Salem (K7)	442	Vincennes (E3)	173		
Mechanicsville (L5)	1,010	Oxford (K5)	633	Salix (A4)	394	Vining (J5)	122		
Medapolis (L6)	1,040	Oxford Junction (M4)	725	Sandborn (B2)	1,323	Vinton (J4)	4,781		
Melbourne (G5)	517	Oyama (L4)	114	Scarsville (F2)	105	Vorlesville (K6)	275		
		Pacific Junction (B6)	500	Scarville (F2)	105	Wadena (C3)	275		
		Packwood (J6)	251	Schaller (C4)	896	Wahpeton (C2)	117		
		Palmer (D3)	271	Schleswig (B4)	785	Walcott (M5)	664		

The libraries at the State College of Iowa and Grinnell College are above average in quality. Excellent municipal libraries may be found in Des Moines, Dubuque, Burlington, and Sioux City.

Major Health and Welfare Agencies and Institutions.—Iowa's health services are provided at the state and local levels of government. The state health commissioner and the Board of Health provide such services as control of cancer and communicable diseases, heart disease studies, maternal and child health care, nutrition programs, public health education, vital statistics, and licensure of medical professions. There are state and local programs for aid to the blind. Rehabilitation for the physically handicapped is a function of the state superintendent of public instruction. The Board of Regents, in its program of higher education, trains physicians, dentists, and nurses. The extensive services of the university hospitals in Iowa City are available to patients from all of Iowa.

The three-man Board of Control was created in 1898 to manage state penal, mental health, and child care institutions, which now number 14 (including an old soldiers' home at Marshalltown). Four state mental health institutions are situated at Independence, Cherokee, Mount Pleasant, and Clarinda, and there are two homes for feeble-minded persons at Woodward and Glenwood. Iowa now employs a mental health specialist to counsel these six institutions and to coordinate work with the University Medical School. Child care agencies include an orphanage at Davenport and a home for older children at Toledo. A hospital for tubercular patients has been transferred from the Board of Control to the Board of Regents so that it is associated with the medical and hospital services of the university. County and city health officials enforce state laws on the local level.

The three-member Board of Social Welfare was created in 1937. It administers state and federal laws dealing with social security, provisions for the aged and the blind, and child welfare. County welfare boards and local social workers provide aid and supervision. The University of Iowa now has a school of social work, so that some social workers are trained in the state.

Penal System and Institutions.—The Board of Control supervises the five state institutions related to correction and punishment. The men's penitentiary was established at Fort Madison in 1839. A men's reformatory is located at Anamosa and a women's reformatory at Rockwell City. Training schools for boys and girls are situated at Eldora and Mitchellville. The governor of Iowa is aided in enforcing the laws of the state by the attorney general and the commissioner of public safety, and in emergencies by the National Guard. The 99 county sheriffs enforce laws in the counties and are in charge of the county jails.

For additional statistics on education and welfare, consult *THE AMERICANA ANNUAL*.

5. ECONOMIC ACTIVITIES

Iowa's economic history began with the fur traders who canoed upstream on the tributaries of the Mississippi River to trade "white man's goods" for pelts. Since Iowa was covered principally with prairie grass, the number of pelts obtained was not great, and the fur trader was an ephemeral visitor on the landscape. The dis-

covery of lead in northeast Iowa (known as the "Lead Mines of Spain" when the area was under Spanish control from 1762 to 1800) led to the development of a brief but rather important mining economy.

Most of the early settlers in Iowa made a living from agriculture; the life of the homesteaders was on a subsistence basis and remained so for many years. After railroads were built to the river cities, the pioneers could sell wheat, corn, salt pork, and hams, and buy cloth, salt, guns, ammunition, and a great variety of items in exchange.

The dominant and basic driving force of Iowa's economic history since these early times has continued to be agriculture. Experiments with crop rotation, animal and plant breeding, feeding formulas for livestock, and mechanization have increased the yields of feed grains per acre and the quality of livestock raised. The State Agricultural College and the 4-H clubs have been leaders in the improvement of farm products and farm living. Only in recent years has the value of manufactured products exceeded that of agricultural products brought to market, and manufacturing remains closely allied with agriculture in the state.

Income.—The median income in Iowa in 1950 very nearly matched the national median for the same year. Between that time and the early 1960's, rises in the average personal income in Iowa lagged behind the national average, due in large part to a cost-price squeeze which affected farm profits. Percentage distribution of Iowans in the various income brackets approximates the percentage distribution in the nation.



O. V. Gordon

Knee deep in corn, this farmer can testify to the fact that Iowa leads all states in production of the grain.

Labor Force.—About 325,000 Iowans, or less than 30 per cent of the working labor force, were engaged in agricultural pursuits in mid-1962.

Agriculture's share of the total labor force steadily declined after 1950, since farm units were getting larger in size and fewer in number and mechanization was making possible greater production with proportionately less manpower.

Of the employed nonagricultural labor force of some 850,000 in July 1962, 25 per cent were engaged in wholesale or retail trade, 25 per cent in manufacturing, and 17 per cent in government services. About a quarter of the nonagricultural workers were members of unions.

Agriculture.—The basis of Iowa's agricultural importance is the large extent of its productive soil. About 25 per cent of the Grade I land in the United States is in Iowa. More than 62 per cent of the land area of the state is in harvested crops; the largest percentage in the nation, and more than 95 per cent is in farms, the average size of which had risen to nearly 200 acres in the early 1960's. The average value of Iowa farmland had, by 1962, reached over \$241 per acre, with all farmlands and buildings valued at about \$8 billion.

The state has traditionally led all others in the production of corn, the annual harvested value of which often approaches \$1 billion. Oats and soybeans are also important. One of the chief uses of Iowa crops is the nourishment of hogs and cattle. The cash income from livestock and livestock products may exceed \$2 billion in a good year, with cattle and hogs each accounting for about 40 per cent of the total, most of the balance being provided by sales of dairy products, eggs, broilers, and sheep. Marketed crops may bring additional cash income of \$300 to \$600 million, of which corn normally accounts for more than half and soybeans for over a quarter.

North central Iowa, totaling 22 counties, is the cash grain area. In this section, land values are higher than in other areas of the state. A high percentage of land is in feed grain, with

a tendency toward two-year rotation and a low percentage in hay and pasture. Corn, oat, and soybean sales total from 40 to 60 per cent of farm sales. Hogs are of less relative importance than cattle. The area is predominantly level, with deep, rich prairie soil. A considerable number of drainage ditches are necessary since this glacial plain is poorly drained.

The dairy region includes 18 counties in northeast Iowa. Even in this section, however, dairy receipts are exceeded by receipts from either hogs or cattle. About 40 per cent of the area is in pasture and hay since much of this land is too hilly for row crops.

Agriculture in the remaining counties is classified as crop and livestock combination. A three-, four-, or five-year rotation plan assures ample feed grains and hay for hogs, sheep, and cattle. Many lambs and feeder cattle are shipped in from Western ranges to be fattened on Iowa-grown grain and hay; pigs are farrowed on the farms. Receipts from the sale of hogs, cattle, and sheep constitute the major source of farm income.

Lumbering.—There are 2.6 million acres in Iowa (over 7 per cent of its area) classified as commercial forest land. Some 1,000 sawmills were operating in the late 1950's, nearly a quarter of them on a full-time basis, and were producing about 90 million board feet annually. Chief species of saw timber are oak, elm, cottonwood, maple, basswood, and black walnut. Iowa forests and wood products bring an annual income of \$18 million to \$20 million. Eight state forests are under the direction of the State Conservation Commission.

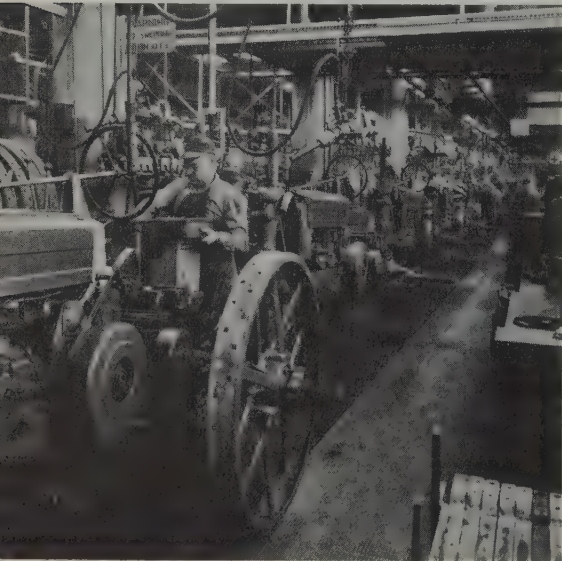
Mining.—Iowa ranked 30th in the nation in value of mineral production in 1961, producing only about 0.5 per cent of the national total. Cement (valued at over \$41 million in 1960) is the most important mined resource, followed by stone other than for cement, sand and gravel, gypsum, and coal. Cement plants are located at Mason City, Davenport, Des Moines, and West Des Moines. Stone for purposes other than the manufacture of cement is quarried almost exclusively in eastern Iowa. Gypsum, in the production of which Iowa ranks third in the United States, is mined in four strip mines located near Fort Dodge. Other deposits of gypsum are known to exist in southern and southeastern Iowa, but at a depth that has heretofore made mining economically unfeasible. Most of Iowa's 300 gravel pits are located in the north central region; those in the south are found along major streams. Coal is mined in the south central counties, about 80 per cent of it by the strip method. Production declined from over 9 million tons in the peak year of 1917 to less than 1.1 million tons in 1961.

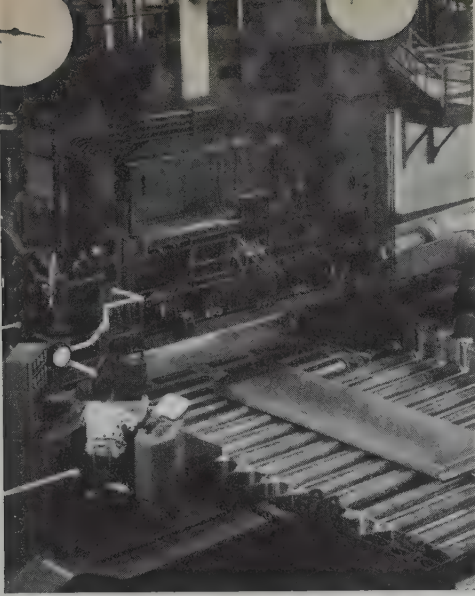
Manufacturing.—Most of Iowa's manufacturing is farm-centered, processing products that come from the farms or making equipment used on them. The principal processed foods are meat, dairy, and grain-mill products; processing meat furnishes employment for more than half of the persons engaged in manufacturing food and kindred products. Tractors, combines, corn pickers, and hay balers are a few of the machines manufactured for use on the farms.

Although there were about 3,700 manufacturing plants in the state in 1960, only a small percentage of them employed more than 50 workers. Des Moines, Cedar Rapids, and Waterloo, in the order

Assembly line of a leading tractor plant, at Waterloo. Iowa manufactures much equipment for its own farms.

John Deere Waterloo Tractor Works





Aluminum Company of America

A huge ingot comes off the hot line of the largest aluminum rolling mill in the United States, at Davenport.

listed, are the leading manufacturing cities. Some plants are nationally known: for example, Iowa had the largest pork processing business, cereal plant, wheel tractor manufacturing plant, washing machine industry, fountain pen manufacturer, and aluminum rolling mill in the United States in 1958. The state has benefited from the expansion of manufacturing in the nation and from the trend toward decentralization; many out-of-state industries now operate one or more factories in Iowa. The total annual output of manufactured products in the state passed the \$4 billion mark in 1955 and the \$5.25 billion mark in 1960. Adjusted value added by manufacture in 1960 was estimated at about \$1,800 million, of which nearly 40 per cent was in food and kindred products and 30 per cent was accounted for by the manufacture of machinery, much of it for farm use.

Power.—Hardly more than a quarter of the potential water power in the state had been developed by 1960, and power was not being produced at all of the 25 dams licensed for its production. About a tenth of the electrical energy in Iowa is hydroelectrically produced, the greatest single source being the Keokuk plant on the Mississippi.

Banking and Insurance.—Some 100 national banks and more than 500 state banks, with total assets of over \$3 billion, operate in Iowa. There are also numerous federal and state mortgage and loan associations, private banks, credit unions, and small loan companies. Insurance is a major business; nearly a score of companies are under charter from the state and there are many fraternal beneficiary associations, fire insurance companies, casualty insurance companies, and branch offices of national insurance companies.

Trade.—Iowa has always lagged behind the United States average in the excess of wholesale over retail sales. This is due in part to the high percentage of agricultural activity, and in part to the large wholesale markets that border Iowa—Chicago, Minneapolis-St. Paul, Omaha, Kansas City, and St. Louis. More than half the total sales of wholesale establishments in the

state are concluded in the 14 largest cities. Because of the importance of agriculture in the economy, food purchases constitute a smaller proportion of total retail trade than in the United States generally, while purchases of farm implements, hay, grain, livestock feeds, and petroleum products play a larger part in the retail turnover.

The only foreign trade center in Iowa is in Cedar Rapids; 10 per cent of the city's labor force earns its livelihood, directly or indirectly, by foreign trade. During the 1950's, about \$25 million worth of goods were exported annually by some 50 firms.



W. A. Scheaffer Pen Company

In plant at Fort Madison, worker examines strip of 14-carat gold from which pen points have been stamped.

For additional statistical data on the economic life of Iowa, consult *THE AMERICANA ANNUAL*.

6. TRANSPORTATION AND COMMUNICATIONS

Transportation.—Rivers and trails formed the basis for early transportation in pioneer Iowa. Canoes, barges, keelboats, and steamboats were early modes of transportation on the Mississippi, the Missouri, and inland rivers; Indian trails, military roads, and stagecoach routes were important before the construction of the railroads. At least five railroads reached the Mississippi River from the East only to be halted for lack of bridges and financial support. Several of the lines had been laid partially across the state at the outbreak of the Civil War, and the Northwestern became the first to span the state during the postwar period. Railroads reached their peak of construction from 1880 to 1890; highways and automobiles, private and commercial air travel,

and renewed river traffic have been added to Iowa's transportation facilities in the 20th century.

Water transportation along the Mississippi is becoming increasingly important in the 20th century because of the series of dams and the nine-foot channel. Coal, oil, and machinery move northward, and farmer's grains move downstream to processors and consumers. The oldest lock on the Mississippi River, at Keokuk, was replaced in 1958 by a new one that expedited barge traffic. An eight-foot channel on the Missouri has resulted in increased freight movement on that river.

In 1960, 24 railroads operated on some 9,500 line miles of railway track in the state of Iowa. Because the pioneers moved westward, east-west traffic became and has remained most convenient, but branch lines were added to provide a network of railways which serve the whole state. At one time it was claimed that no Iowa town was more than 12 miles away from a railroad. In the 1950's considerable railroad passenger service was eliminated. The last electric streetcar to serve the state was discontinued in 1958.

There are more than 200 airports in the state; in the early 1960's some 2,000 airplanes were registered by the Iowa Aeronautics Commission, and about 10,000 Iowans held pilots' licenses. Four major airlines maintained airports, and additional air service was provided by feeder lines.

Serving automotive transportation are over 110,000 miles of roads classified as either state primary roads, state secondary roads, county truck roads, or county local roads. Iowa has a heavy road expenditure program (over \$100 million per year), partly because there is less waste land here than in most states. Each section of land is bordered by a road, so that every farmer has transportation facilities. A major effort in highway construction was made in the 1920's, and a long-range highway-widening program was inaugurated in 1955. Federal funds are providing

impetus for the construction of one east-west freeway across the state and two north-south freeways. Local roads are varied in quality, but all county roads have some type of all-weather surfacing. Much of the state road income is derived from a six-cent-per-gallon fuel tax, motor vehicle registration fees, and a use tax on automobiles and equipment.

Communications.—The state has no regulatory agency to supervise communications. In 1961, 46 daily newspapers and some 400 others were published in Iowa. The *Des Moines Register* and *Des Moines Tribune*, a morning and an evening daily, have statewide circulation, and the monthly magazine *Better Homes and Gardens*, published in Des Moines, is read throughout the country. There were 82 AM radio stations in 1962, 14 FM stations, and 13 television stations (2 UHF and 11 VHF). Business and residential telephones in use in the state in that year numbered more than 1.2 million.

7. CULTURAL LIFE

Cultural activities are largely the monopoly of the educational institutions of the state, both publicly and privately supported, though in some cases municipal forces join in the support of symphony orchestras and choral organizations. Des Moines, Waterloo, Sioux City, Davenport, and Burlington are outstanding for this kind of cooperation between "town and gown." A very enthusiastic art movement has swept the state in the last 20 years; all the larger cities and many smaller cities and towns have leagues or associations which support galleries, sponsor exhibitions, and conduct training classes. The Des Moines Art Center is most notable in this respect.

The little theater movement is most active in Des Moines, Waterloo, Sioux City, and Davenport. Nearly every town and city in the state has an organization for the presentation of concert artists; several of them bring performers of world fame to their audiences.

8. PLACES OF INTEREST

A number of state parks provide facilities for recreation and the appreciation of nature's beauties but little of educational value or historical interest. A national park, the Effigy Mounds National Monument, near Marquette, possesses real interest for both the casual traveler and the student of archaeology. A privately endowed museum at Cherokee, the Sanford Museum of Natural History, contains artifacts from a site known as the Mill Creek excavations.

The Hoover Birthplace Park at West Branch contains buildings associated with the birth and early life of Iowa's only presidential son; a library-museum, opened in 1962, houses valuable papers from the Hoover collection formerly at Stanford University and displays materials relating to Mr. Hoover's career.

The Bily clocks, an unusual collection of hand-carved clocks of all sizes and styles, are housed at Spillville. This exhibit, together with the little town's associations with the memory of Anton Dvořák's residence there, brings thousands of visitors annually.

9. FAMOUS MEN AND WOMEN

Iowans who have achieved distinction in various fields of activity include the following: Herbert Clark Hoover (born in West Branch, 1874–), 30th president of the United States; Henry Agard Wallace (Adair County, 1888–), former secretary of agriculture and vice presi-

Herbert Hoover's birthplace, at West Branch.

Iowa Development Commission

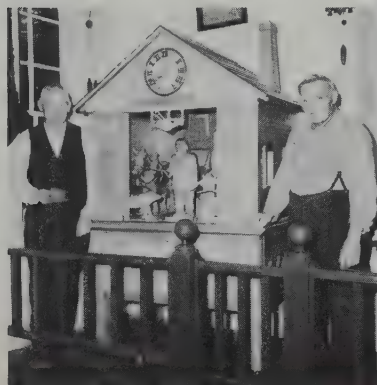




Above: Handsome trees frame the campania of Iowa State Teachers College at Cedar Falls.

Below: The Bily brothers, of Spillville, are famous for their clock collection, a tourist attraction.

(Above and below) Iowa Development Commission



Above: Bridges spanning the Cedar River link sections of Cedar Rapids and Municipal Island.

United Press International

IOWA

Right: An Iowa farmer watches some of his young hogs. Pork production ranks high in the state.

Below: A neighborhood dance in a farmer's barn. Folk dancing is a popular diversion in Iowa.

(Right and below) O. V. Gordon



dent of the United States; Harry Lloyd Hopkins (Sioux City, 1890-1946), public official and administrator; Edwin Thomas Meredith (Avoca, 1876-1928), secretary of agriculture; William Daniel Leahy (Hampton, 1875-1959), naval officer and presidential adviser; William Ashley (Billy) Sunday (Ames, 1863-1935), evangelist; William Frederick (Buffalo Bill) Cody (Scott County, 1846-1917), scout and showman; Newell Dwight Hillis (Magnolia, 1858-1929), Congregational clergyman; and Glenn L. Martin (Macksburg, 1886-1955), airplane designer.

In the field of literature, the state is represented by Bess Streeter Aldrich (Cedar Falls, 1881-1954), novelist; Thomas Beer (Council Bluffs, 1889-1940), novelist and biographer; Richard Pike Bissell (Dubuque, 1913-), novelist and playwright; Ellis Parker Butler (Muscatine, 1869-1937), humorist; Marquis William Childs (Clinton, 1903-), journalist and author; George Cram Cook (Davenport, 1873-1924), novelist and playwright; Thomas William Duncan (Casey, 1905-), novelist; Paul Hamilton Engle (Cedar Rapids, 1908-), poet; Susan Glaspell (Davenport, 1882-1948), novelist and Pulitzer Prize winner; James Norman Hall (Colfax, 1887-1951), author; Harry Hansen (Davenport, 1884-), editor, critic, and war correspondent; James Schell Hearst (Cedar Falls, 1900-), poet; Emerson Hough (Newton, 1857-1923), novelist; MacKinlay Kantor (Webster City, 1904-), novelist and short story writer; Honoré Willies Morrow (Ottumwa, 1880?-1940), novelist; Philip Duffield Stong (Keosauqua, 1899-1957), novelist; Ruth Suckow (Hawarden, 1892-1960), novelist; Carl Van Vechten (Cedar Rapids, 1880-), novelist; and Margaret Wilson (Traer, 1882-), novelist and Pulitzer Prize winner.

In the field of music, painting, and sculpture the best-known names are Marvin Cone (Cedar Rapids, 1891-), painter and sculptor; Abastenia St. Leger Eberle (Webster City, 1878-1942), sculptor; Sherry Edmundson Fry (Creston, 1879-), sculptor; Nellie Verne Walker (Red Oak, 1874-), sculptor; Meredith Willson (Mason City, 1902-) conductor and composer; and Grant Wood (Anamosa, 1892-1942), painter.

10. HISTORY

Prehistory.—Serious anthropological and ethnological studies have only recently begun in the Iowa region. Finds in the northeast (the most typical now preserved in Effigy Mounds National Park) and in gravel pits near Turin in western Iowa are still undergoing study. It cannot be disputed, however, that the land was once occupied by a population different in its habits from the Indians encountered by the pioneers. Several distinct cultures have been tentatively identified from the traces left by these "mound builders," who may or may not have been direct ancestors of the later Indians.

Discovery and Early Possession.—The first recorded sight of the future state by white men occurred on or about June 17, 1673, when Father Jacques Marquette and Louis Jolliet (or Joliet) arrived at a point on the Mississippi opposite the mouth of the Wisconsin River, a spot commemorated today by a nearby village named in honor of Marquette. Their journey continued southward, and they may have conferred with the Indians at the mouth of the Iowa River. Their discoveries gave France the basis of a claim to a vast region far beyond the seigniories of Quebec. Thus "Iowa" became, as a part of Louisiana, a dot on the map of Louis XIV's French Empire.

In 1763 the Louisiana portion of this empire was ceded to Spain and retained by her until 1800, when pressure from Napoleon forced its return to France. The only lasting evidence of the Spanish tenure is to be found in three land grants which later entered into court records. The first of these, in 1796, was to Julien Dubuque, who carried on extensive lead-mining operations near the site of the modern city which bears his name; another was to Louis Honoré Tesson, in 1799, near present-day Montrose; the last was to Basil Giard, in 1800, near present-day McGregor.

Territorial History and Admission to Statehood.—"Americanization" began after the Louisiana Purchase Treaty of 1803, making Iowa

part of the United States. The future state's first American benefactors may be said to have been Meriwether Lewis and William Clark; it is notable that the first white man buried on Iowa soil (near Council Bluffs) was a member of their expedition.

The region which became Iowa was first a part of the District of Louisiana, but under the jurisdiction of the governor of the Territory of Indiana. During this period a few courageous or desperate souls came into the area in spite of the Land Act of 1805, which forbade its settlement by whites. In 1812 it became a part of the Territory of Missouri and was greatly affected by that provision of the Missouri Compromise (1820) which forbade slavery forever in any part of the territory north of the line of 36° 30', except in Missouri itself.

After Missouri became a state in 1821, "Iowa" was officially neglected and ignored until after the Black Hawk War of 1832. The remainder of the Louisiana Purchase was assigned to Michigan Territory in 1834, and statehood for Michigan (1836) left the Territory of Wisconsin next in succession. In 1838, Wisconsin Territory was delimited to the area of the present state, and the remainder of the Purchase came onto the map as the Territory of Iowa. The capital was located first at Burlington, and after 1841 at Iowa City. The formal processes of admission to statehood were set in motion in 1844, and after a prolonged dispute over boundaries, the state was admitted in 1846.

Indian Affairs.—The earliest pioneers encountered several Indian tribes, most important of which were the Iowas, of Siouan stock, whose name came to be applied to the region. Subsequently the Sac and Fox Indians, the Potawatomi, and the Winnebagos moved or were moved into the area, yielding to the relentless westward pressure of the white man. By 1824 the Indians were compelled to cede a portion of land in the southeast as a "Half-breed Tract"; in 1832, following the defeat of Black Hawk and his Sac and Fox warriors, the "Black Hawk Purchase" secured a large area just west of the Mississippi to white settlement. In 1836, 1837, and 1842, the Sac and Fox agreed peacefully to three successive withdrawals from their lands and evacuated to Kansas, though some of them were later to return to settle on purchased lands in Tama County. The Potawatomi gave up their holdings in the southwest in 1846, and the Winnebagos left their lands in the northeast in 1848. The Sioux conceded their losing battle in 1851, but a few of their tribe returned in 1857 to perpetrate the massacre of Spirit Lake, which lives on in the recorded history of the state as well as in its legends.

Early Statehood.—The first state constitution (1846-1857) was a typical expression of the prejudices of frontiersmen, especially on the subject of banks and bankers. The capital was located at Iowa City; the first governor was Ansel Briggs. The vigorous leadership of Governor James W. Grimes secured a new constitution (1857) which, with amendments, still serves. The capital was moved to Des Moines the same year.

The era was one of growing tensions between slavery and antislavery forces throughout the nation. Iowans in great numbers moved into the new Republican Party, formed in 1854-1856 to oppose the expansion of slavery into new territories. Iowa Democrats, until 1854 the political

masters of the state, now found themselves facing the same dilemma as Democrats elsewhere in the North: to defend slavery and preserve party unity or to condemn it and split the party nationally. Some were willing to take the latter course; one Iowan, Benjamin M. Samuels, took a leading part in the division of the party at the Charleston (S.C.) convention in April 1860.

Civil War and Reconstruction.—During the Civil War, Iowans contributed a fair share toward the support of the Union cause in military manpower, economic production, and financial and material gifts and loans. Some 80,000 men went out from the state to fight, and about 12,000 lost their lives. Of immeasurable importance was the staunch support given to President Abraham Lincoln's war effort by the dominant Republican Party in Iowa. In 1862 and 1864, as other states wavered or fell away, Iowa Republicans rolled up safe majorities. Their opponents, meanwhile, compounded their political difficulties by dividing into War Democrats and Peace Democrats, neither of whom could wholly escape the "party of treason" stigma.

This political situation carried over into the Reconstruction period, when nearly all Iowa Republicans became pronounced Radicals. It is hardly an exaggeration to say that the advantage gained by the Republicans during the war and Reconstruction guaranteed them a supremacy which only a political "revolution" could destroy.

Agrarian Radicalism.—Beginning in the closing months of the Civil War, a deflation in the national economy occurred, destined to last until the end of the century. This naturally brought forth a variety of proposals designed to end or alleviate the distress. Since these proposals were often presented with evangelical fervor by eccentric figures who belonged to minority groups, they were lumped together under the prejudicial label "agrarian radicalism."

The remedies proposed were: (1) a greater use of greenbacks (unsecured paper money); (2) free silver (unlimited coinage of silver dollars); (3) regulation of railroads (popularly known as "Grangerism"); and (4) antimonopoly measures. All resulted in compromises.

The Greenback movement began in 1864, when an Iowan, Henry Clay Dean, a Peace Democrat usually held up to ridicule, published *Crimes of the Civil War* as a call for unlimited issues of greenbacks. The Resumption Act of 1875 (providing for the redemption of greenbacks in gold) was a crushing blow to the movement, and it petered out during the next 10 years, though an Iowan, James B. Weaver, ran for president as a Greenbacker in 1880. The free silver agitation rose to its height after the so-called "Crime of '73," when Congress struck silver dollars from the list of mintable coins. An Iowa senator, William Boyd Allison, helped to compromise the matter by providing the key amendments to the Bland-Allison Act (q.v., 1878). By his plan, a limited number, whatever number provided by the purchase of \$2 million to \$4 million worth of silver ore, as determined by the secretary of the treasury, were to be coined into silver dollars each month. This measure was inadequate according to the prevailing view in Iowa. Free silver died in the election of 1896 and in the economic upturn of the closing years of the 19th century.

Regulation of the railroads and antimonopoly legislation were closely related. The Granger

movement was not purely rural in origin or application, and regulation of the railroads was strongly desired in Iowa by the merchants of the Mississippi River towns who suffered from the long haul and pooling policies of the roads. Iowa's law of 1874 is frequently mentioned as the first attempt at state regulation. The state's activities in this field culminated in the positive program of Governor William Larrabee (1886-1890).

The Populist (People's Party, q.v.) movement of the 1890's was an expression of all these efforts at reform and uplift. James B. Weaver was again the third-party presidential candidate in 1892, although the Populists were not very strong in his home state.

Progressive Era.—The blend of reformism and social progress known as Progressivism invaded both major political parties in the early 1900's, but was most notable, especially in Iowa, in the Republican Party. Among the leaders of this movement were Albert Baird Cummins, governor (1902-1908) and United States senator (1908-1926), and Jonathan Prentiss Dolliver, United States senator (1900-1910). In Iowa the chief accomplishments were the anti-railroad-pass law, the direct primary law for senatorial nominations, better support for education, better penal laws, and stricter regulation of railroads and insurance companies.

World War I and the Agricultural Depression.—During the war years 1914-1918, American farmers were encouraged by economic factors and government persuasion to put all possible land into agricultural production. Iowa farmers responded enthusiastically and for a time enjoyed considerable prosperity. Prices of all farm produce rose to unheard of heights, and land values reached a peak which was not to be equaled again even in the 1950's. All too often, however, land was bought on a mortgage plan.

When the war ended and the governments of the world retired from the markets, prices fell disastrously. Farm purchasers were unable to meet their payments, and many banks and insurance companies were forced into ruin or into desperate measures. A severe farm depression was a reality by 1920-1921 and dragged on through the remainder of the decade. Many proposals were brought forth for the relief of agriculture, the principal one being the bill sponsored by Senator Charles L. McNary of Oregon and Congressman Gilbert N. Haugen of Iowa, the latter a long-time spokesman for agriculture in Congress. The legislation, designed to raise the domestic price of farm products above the world price, twice passed Congress but was vetoed each time by President Calvin Coolidge. The Farm Marketing Loan Board Act (1930), providing for government purchase and orderly marketing of farm produce, was a failure in practice. Many Iowans were brought to the point of desperation, as reflected by such acts as the dumping of milk trucks and the unpardonable mistreatment of a jurist who had merely done his duty as he saw it.

New Deal, World War II, and After.—In the elections of 1932, for the first time since 1849, the Democrats elected a governor in a race against an undivided Republican Party (the latter had been divided by a dispute over prohibition in 1889 and 1891). The Democratic national administration acknowledged the importance of the agricultural problem by selecting a successful Iowa agricultural journalist and plant breeder, Henry A. Wallace, as secretary of agriculture. Measures

were introduced to bring supply and demand more closely into line. The question of the wisdom of such policies was taken into the political arena, and by 1939 the Republicans had returned to power in the state.

More than a quarter of a million Iowans served in the armed forces during World War II. Wartime demands for foodstuffs brought new prosperity, and the much-feared postwar depression failed to materialize, prices and living conditions finding a peacetime level well above that of 1939. Inflation became a serious problem in the 1950's when the prices of the manufactured goods needed by farmers rose faster than the prices which they could get for their agricultural produce. The consequent squeeze on profits hastened the trend toward larger farms and greater mechanization, as farmers sought to control costs by increasing operating efficiency. This process continued unabated in the early 1960's.

Democrat Hershel C. Loveless won the governorship of Iowa in 1956, ending nearly two decades of Republican rule. Republicans recaptured the executive office in 1960 with the election of Norman A. Erbe, but lost it to another Democrat, Harold E. Hughes, in 1962. Meanwhile, other state house elective offices, as well as the General Assembly and the state's Congressional delegation, remained predominantly Republican.

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LELAND L. SAGE,
ERMA PLAETHN,
HERMAN NELSON,
State College of Iowa.

IOWA, State College of, a coeducational professional college at Cedar Falls, Iowa, offering training for all types of teaching positions in the public schools. The institution is fully accredited and is governed by a nine-member, governor-appointed Board of Regents. It offers B.A. degrees in teaching and in the liberal and vocational arts, the M.A. degree in education, and a sixth-year program leading to a specialist in education degree. The school has a 470-acre campus and 20 major buildings, including a library housing nearly 200,000 volumes.

Established in 1876 as the Iowa State Normal School, it was renamed the Iowa State Teachers College in 1909. Under that name, the institution attained a national reputation as a leading college in the field of teacher education. The name of the college was changed to State College of Iowa in 1961, when it began to offer the B.A. degree in the liberal and vocational arts for students not planning to teach. The college-operated Malcolm Price Laboratory School enrolls about 700 children from nursery through high school and is recognized as one of the nation's finest. State College athletic teams, known as the "Panthers," compete in all major intercollegiate sports; the school colors are purple and gold; and the

school song is the *SCI Loyalty Song*. Average annual enrollment exceeds 4,500.

LOREE WILSON,
State College of Iowa.

IOWA, State University of, a coeducational, state-supported institution of higher learning located in Iowa City, Iowa. It was founded in 1847 by the First General Assembly of the State of Iowa and began to give instruction in 1855. The university is governed by the State Board of Regents, whose nine members are appointed by the governor, subject to confirmation by the Senate. The academic divisions are the colleges of Liberal Arts (including schools of journalism, religion, fine arts, and social work), Law, Medicine, Dentistry, Pharmacy, Nursing, Engineering, Education, and Business Administration, and the Graduate School. Degrees through the doctorate are conferred.

Among the other divisions of the university are the Agricultural Law Center, Institute of Agricultural Medicine, Institute of Hydraulic Research, Bureau of Labor and Management, Bureau of Business and Economic Research, Institute of Public Affairs, Iowa Center for Continuation Study, Iowa Institute of Gerontology, Iowa Urban Community Research Center, and the Extension Division. There are 1,000 beds in the hospitals comprising the university's medical center. State patients are brought to Iowa City from any point in Iowa by means of an ambulance system.

Students attend classes on a campus that covers some 1,330 acres. The University Library system contains more than one million volumes. Among the library's special collections are an extensive Leigh Hunt collection, an Abraham Lincoln collection, and a collection of original cartoons by Jay Norwood ("Ding") Darling. The school colors are old gold and black and the athletic teams are known as the "Hawkeyes." The school songs are *On Iowa* and *Iowa Fight Song*. Annual enrollment averages about 12,000.

KEN DONELSON,
State University of Iowa.

IOWA CITY, city, Iowa, the seat of Johnson County, in the east central part of the state. It is on the Iowa River, about 120 miles east of Des Moines and 60 miles west of Davenport. Situated on federal and state highways, the city also has an airport. Iowa City is located in a rich agricultural area. Its industries include the manufacture of soap and drug products, toothbrushes, frozen foods, and animal feeds. The State University of Iowa (see IOWA, STATE UNIVERSITY OF), whose campus is divided into two sections by the river, plays a major part in civic life and has contributed to the development of Iowa City as an important cultural, medical, and industrial center. The city is the site of the state school for crippled children, state general and mental hospitals, a veterans hospital, and the State Historical Society Library.

Platted in 1839, Iowa City was established by the Iowa Territorial Legislature. It was the capital of the territory from 1841 and of the state from 1846 until 1857, when the seat of government was moved to the more centrally located city of Des Moines. The original capitol building, a stone structure in the Doric style erected in 1840, still stands, serving now as the administrative center of the university. For some time

after 1856, Iowa City was the western terminus for a pioneer railroad, from which immigrants traveling west started out with handcars or covered wagons. Earlier, during the winter of 1846, Brigham Young's band of Mormons found sanctuary here en route from Nauvoo, Ill., to the Utah Territory. A prominent 20th century resident has been Dr. James Van Allen, head of the university's physics department, after whom the Van Allen radiation belts were named. Iowa City is governed by a city manager. Pop. 33,443.

JOYCE E. NIENSTEDT,
Librarian, Public Library of Iowa City.

IOWA FALLS, city, Iowa, in Hardin County, on the Iowa River, 85 miles by highway north of Des Moines. It is served by three railroads and has a municipal airport. It is in an agricultural area producing soybeans, corn, oats, hogs, cattle, and poultry. Industries and trade are represented by feed milling and processing, construction, production of concrete, and leather goods manufacture. Ellsworth Junior College is located here, and the city boasts a 40-acre park system, a public library, a hospital, a radio station, and a community theater. First called Rocksylvania, it was founded in 1854 and incorporated in 1869 as Iowa Falls, taking its name from a local waterfall. It has a council-manager form of government. Pop. 5,565.

LUCILE MILLER.

IOWA INDIANS or **IOWAY INDIANS**, *i'ō-wā* (Siouan, meaning uncertain; possibly *Ayuhwa*, "sleepy ones" or *Aiyuwwe*, "marrow-eaters"). A small tribe of the Siouan linguistic family related to the Oto and Missouri, all of which were at one time part of the Winnebago tribe. The Iowa eventually separated from this group and settled in the state which later adopted their name. Never a large tribe, they probably numbered 1,000 at most. In the early 1960's, some 550 lived in Kansas and 125 in Oklahoma, on lands given to them by treaty.

FREDERICK J. DOCKSTADER.

IOWA RIVER, river, Iowa. It rises in Hancock County, near the Minnesota state line, and flows southeast into the Mississippi River, 30 miles north of Burlington, Iowa. It is 291 miles long and navigable to Iowa City (some 80 miles).

IOWA STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY, a coeducational, land-grant institution at Ames, Iowa, known before 1959 as the Iowa State College of Agriculture and Mechanic Arts. It occupies a campus and recreation area of nearly 1,000 acres, landscaped into a naturalistic park in the city of Ames. About 8,000 additional acres are operated as experimental areas near Ames and in various sections of the state. The university consists of the colleges of Agriculture, Engineering, Home Economics, Sciences and Humanities, and Veterinary Medicine, and the Graduate College. The latter is one of the nation's largest graduate colleges specializing in science. The University Library at Ames houses over 500,000 volumes.

Approximately a third of the annual operating budget of the university is allocated to research conducted in the Agricultural and Home Economics Experiment Station, the Engineering Experiment Station, the Industrial Science Research Institute, the Veterinary Medical Research Insti-

tute, and the Institute for Atomic Research. An integral part of the Institute for Atomic Research is the Ames Laboratory of the United States Atomic Energy Commission, a major basic research laboratory employing about 700 persons.

The university was chartered by the Iowa General Assembly in 1858 as the State Agricultural College and Model Farm. It graduated its first class in 1872. The school now offers B.S., M.S., Ph.D., professional, and teaching degrees. The university colors are cardinal and gold and its athletic teams, nicknamed the "Cyclones," compete within the "Big Eight" (Missouri Valley Intercollegiate Athletic Association). Annual enrollment averages about 11,000; it includes a heavy enrollment in engineering, as well as the largest home economics program and largest undergraduate enrollment in agriculture in the world.

ROBERTA F. VANCE.

IPECAC, *ip'ê-kāk*, a drug consisting of the dried roots and rhizomes (horizontal underground stems) of certain plants of the genus *Cephaelis* (madder family, Rubiaceae) of tropical America. Two species, *C. ipecacuanha* (Rio or Brazilian ipecac) and *C. acuminata* (Cartagena, Nicaragua, or Panama ipecac), are recognized as official in the United States pharmacopoeia. Although the drug had long been used by certain South American Indians, it was not introduced into European medicine until the late 17th century. Its original use was for treatment of dysentery, for which it is now seldom used; it is effective against only amebic—not bacillary—dysentery. Today, ipecac is employed mainly as an emetic and an expectorant, especially in the treatment of certain respiratory affections. It may be administered in powder or tablet form or in various fluid forms, most commonly as syrup of ipecac. The active ingredients are several alkaloids, principally emetine and cephaeline. Some ipecac is cultivated in India and Malaya.

JOHN W. THIERET.

IPHIGENIA, *if-i-jê-ni'ā*, in Greek mythology, a daughter of Agamemnon and Clytemnestra. Her father, who had offended the goddess Artemis, was required to sacrifice Iphigenia to secure the release of the Greek fleet from Aulis, where it had gathered prior to the Greek attack on Troy. At the moment of sacrifice, Artemis, who suddenly relented, substituted for Iphigenia on the altar a beautiful hind and conveyed the girl in a cloud to distant Tauris (now the Crimea), where she became the priestess to the goddess.

At Tauris, in conformance with the law of the country, she was obliged to sacrifice every Greek who landed there. Among the visitors was her brother Orestes, who came to obtain the Taurian image of Artemis as an expiation for the murder of his mother (see CLYTEMNESTRA). Soon after his arrival, Iphigenia revealed her identity to him, and the two contrived to escape with the image and return to Greece.

The two episodes in the story were dramatized by Euripides, whose *Iphigenia in Aulis* and *Iphigenia in Tauris* are the most common sources for the legend. The Aulis episode was later treated by Jean Jacques Racine and Christoph Willibald Gluck (see IPHIGÉNIE EN AULIDE); the Taurian episode, by Gluck (see IPHIGÉNIE EN TAURIDE) and by Johann Wolfgang von Goethe, in the verse tragedy *Iphigenie auf Tauris* (1786).

IPHIGENIE EN AULIDE, ē-fē-zhâ-nē' ān-nôlêd', the name of a verse tragedy in 5 acts by Jean Jacques Racine and an opera in 3 acts by Christoph Willibald Gluck. Racine's drama was first presented at court in 1674 and to the public in the following year. Coming after such oriental subjects as *Bajazet* and *Mithridates*, *Iphigénie en Aulide* was a return to the classical world of *Andromache* (1667) and has been ranked among the author's best works. The plot follows the Euripidean drama (see **IPHIGENIA**), with one notable exception. Racine introduced the character of Eriphile, a captive of Achilles who accompanies Iphigenia to the Greek camp, and having fallen in love with Achilles, warns the Greeks of her rival's attempt to flee on hearing her fate. Iphigenia is prepared for her death when Calchas announces that Eriphile fulfills the requirements of the sacrifice and is put to death in the place of Iphigenia.

Gluck's opera *Iphigénie en Aulide* was first produced in Paris in 1774 (see **GLUCK**; **OPERA—Gluck**) on a libretto by the Marquis Du Rollet. It also follows the general outlines of Euripides' tragedy, with an altered denouement. Achilles tries to save Iphigenia from the sacrifice but she, not wishing to see the hero disgraced, resolves to die. Just as the sacrifice is about to take place, Achilles is prepared to rescue Iphigenia by force of arms, but the goddess Artemis interposes, declaring herself appeased and the opera ends with Iphigenia and Achilles momentarily united before the latter leaves for Troy.

An arrangement of Gluck's *Iphigénie en Aulide* was made by Wagner and performed in Dresden in 1847. For Gluck's other opera based on the Iphigenia legend see **IPHIGÉNIE EN TAURIDE**. Other operas on the Aulis events of the legend were composed by Antonio Caldara (1718); Karl Heinrich Graun (1748); and Luigi Cherubini (1788).

IPHIGENIE EN TAURIDE, ē-fē-zhâ-nē' ān tô-rêd', an opera in 4 acts by Christoph Willibald Gluck, with a text by Nicolas François Guillard, first performed in Paris in 1779. In the operatic "war" between Gluck and the Italian composer, Niccolò Piccini, both composers were commissioned to write an opera on this subject and Gluck's, produced first, established his position as the leading opera composer in Paris.

The plot is substantially that of the original legend with minor variations (see **IPHIGENIA**). At the end, Pylades escapes and returns just as the Taurian king is about to sacrifice both brother and sister, stabs the king, and the three of them sail away in safety. Among the several other composers who set this story to music are André Campra (1704); Tommaso Traetta (1763); and Baldassare Galuppi (1768).

IPPOLITOV-IVANOV, ĩp-pŭ-lyě'tóf-ĩ-vâ'nóf, Mikhail Mikhailovich, Russian composer: b. Gatchina, near St. Petersburg, Nov. 19, 1859; d. Moscow, Jan. 28, 1935. In 1881, to avoid confusing his real name, Ivanov, with a music critic of the same name, he added his mother's name to his own. A student of Rimski-Korsakov in St. Petersburg he made his debut there as a composer and conductor in 1883, and for ten years at Tiflis in the Caucasus he directed the music school, conducted at the Imperial Theater, and studied Georgian folk music, whose influence on his musical style has linked him with the Russian National

School. After 1893 he taught and composed in Moscow. Ippolitov-Ivanov's compositions include the operas *Ruth* (1887), *Azra* (1890), *Ole from Nordland* (1916), and the completion of Musorgski's opera *Marriage* (1931); one symphony (1907); many orchestral pieces, of which the *Caucasian Sketches* is the most popular; and works for chamber and vocal groups. Complying with the spirit of the Soviet regime, he also composed a revolutionary opera *The Last Barricade* (1933-1934) and several songs and marches, some of which were used by the Red Army. He was the author of *The Science of the Formation and Resolution of Chords* (1897, in Russian) and *Fifty Years of Russian Music in My Memories* (1934; in English, *Musical Mercury*, New York, 1937).

IPSEN, ĩp's'n, Ernest Ludvig, lŏöth'vêg, American portrait painter: b. Malden, Mass., Sept. 5, 1869; d. Miami, Fla., Nov. 2, 1951. He studied at the Boston Museum of Fine Arts and the Royal Academy at Copenhagen, and is known for the many portraits of famous persons which hang in galleries and educational institutions throughout this country. Since 1923 a member of the National Academy, he won the Lippincott prize for his *Mr. Lauth and Bottles* at the Pennsylvania Academy of Fine Arts exhibition in 1936, and many other awards. Among his portraits are those of Elihu Root, Dr. Henry van Dyke, Chief Justice William Howard Taft, and General Robert E. Lee.

IPSWICH, ĩps'wĭch, city, Australia, in Stanley County, Queensland, on the Bremer River, 20 miles west-southwest of Brisbane. It is located in a thriving agricultural region, also favored with extensive coal deposits. It has iron foundries, woolen mills, and lumber yards. Pop. (1947) 26,218.

IPSWICH, county borough, England, a river port in Suffolk, on the Orwell River at its confluence with the Gipping, 10 miles northwest of Harwich and 68 miles northeast of London. The older parts of the town have narrow crooked streets, some of the old houses of which are ornamented with curious carved work. It contains numerous churches and benevolent institutions, a town hall, art museum, mechanics' institute, corn exchange and an ancient mansion of the Tudors. Of its educational establishments the principal is the grammar school founded by Cardinal Wolsey and endowed by Queen Elizabeth.

The Saxon Gypeswyk, Ipswich was also a Roman settlement, remains of which still exist. It was pillaged by the Danes in 991 and again in 1000. The modern city is a large industrial center, manufacturing railway supplies, agricultural implements, electrical equipment, nonferrous metals, feed cakes, and sugar. Pop. (1951) 104,788.

IPSWICH, town, Massachusetts, in Essex County, 28 miles northeast of Boston on the Ipswich River, state highways, and the Boston and Maine Railroad. Altitude 30 feet. Ipswich's major industry was the manufacture of hosiery until 1927, when the mills were closed and their machinery sold to Russia. Several minor industries now occupy the mill buildings. Ipswich is a popular summer resort and famous for its shellfisheries and Crane's Beach for swimming.

Among the landmarks of the town are the Whipple House (1640), the South Church (1748), and the John Heard House (late 18th century). Anne Bradstreet and Nathaniel Ward also were early residents.

The town was settled as Agawam (Aggawam) in 1633 by John Winthrop and a group of 12 pioneers. By the following year it was incorporated under the name of Ipswich (after Ipswich, England) by resolution of the Massachusetts General Court. As early as 1634 it had a meeting house. The town was one of those which offered stubborn resistance to the arbitrary taxation introduced under Governor Edmund Andros, and a number of its citizens were punished for this action. The Rebellion Tablet marks the spot where the townfolk gathered to protest the governor's oppression nearly 100 years before the American Revolution. The township includes Ipswich village (pop. 4,617), and since 1951 has been governed by a city manager. Population: 8,544.

IQUIQUE, ē-kē'kā, city, Chile, seaport and capital of Tarapacá Province on the edge of the Atacama Desert, about 250 miles north of Antofagasta. Since rain seldom falls, the water supply has to be piped from the oasis of Pica, a distance of about 60 miles.

Served by railroads and an airport, the city is a trading and manufacturing center with petroleum and sugar refineries, cement factories, and fish-canning plants. Nitrates are mined and shipped from nearby deposits; iodine and salt are also exported.

Founded in the 16th century, Iquique was almost entirely destroyed by earthquakes in 1868 and again in 1877. In 1879, during the War of the Pacific, the city was taken by Chile from Peru, and by the Treaty of Ancón (1883) the province of Tarapacá was ceded to Chile. Population: (1960) 50,655.

IQUITOS, ē-kē'tōs, city, Peru, river port and capital of the Department of Loreto, on the upper Amazon near the mouth of the Nanay River, about 1,200 air miles northeast of Lima; altitude about 350 feet. Ocean-going vessels drawing 14 feet ascend the Amazon to this point and the river is navigable for lesser craft for 425 miles farther up. It has regular steamship connection with Belém, Brazil, via Manaus, connecting there with steamers for the United States and Europe. There are also frequent sailings for all places on the larger tributaries of the Amazon, and small launches keep in touch with small settlements, some of them 400 miles from the Amazon.

Iquitos is the trade center for the entire area of Peru lying east of the Andes. The chief exports, based on produce of the surrounding area, are rubber, tobacco, cotton, timber, oil nuts, balata, and some raw hides. The city has machine shops, sawmills, shipyards, cotton gins, factories making straw hats and soaps (from cottonseed oil), and distilleries producing rum from sugarcane juice. In the territory surrounding the city, which is chiefly agricultural, the main crops are cotton, corn, tobacco, and rice. Cattle are raised, and some of the forest clearings have been turned into promising banana plantations.

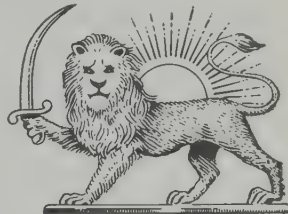
Iquitos dates from 1863, when a settlement was founded on the site of a fishing village. Population: (1961) 57,777.

IRAN, ē-rān', is a Muslim country in the Middle East. Known in Europe for centuries as *Persia*, the country demanded official recognition as Iran in 1935, but since 1949 has accepted *Persia* as an official alternative.

The country is bounded by the Soviet republics of Armenia, Azerbaïdzhān, and Turkmen on the north, Afghanistan and Pakistan on the east, the Arabian Sea on the south, the Persian Gulf on the southwest, and Iraq and Turkey on the west. With a total area of 636,363 square miles, the country is more than one fifth the size of the United States.

According to the results of the first general census, taken in November 1956, the total population was 18,954,704 (1964 est., 22,860,000). Teheran (Tehran), the capital, had a population of 1,512,082 in 1956 (1960 est., 1,839,000). At the time of the 1956 census it was estimated that the average population density was about 30 people to the square mile. The greater portion of the population is concentrated in the western and northern sections of the country. In the desert area and much of the southeast, the population is sparse, the average being less than 10 persons per square mile.

The official flag of Iran has three horizontal bars—green, white, and red; on the white bar is a golden lion holding a sword in one upraised paw, with the rising sun behind its back (for



Coat of arms

picture, see FLAG). The national anthem, officially adopted in 1934, is entitled *Salām-i Shāhānshāh va Sorūd-i Rasmi-yi Melli-yi Irān* (*Greeting of the King of Kings and Official National Anthem of Iran*). The better-known first line is *Shāhānshāh-i mā zandeh bādeh* (*Long Live Our King of Kings!*).

POLITICAL DIVISIONS OF IRAN

	Population (1956)	Capital City	City population (1956)
<i>Ostāns</i> (Provinces)			
Baluchistan-Seistan	428,363	Zahidan	17,495
Central (Teheran)	3,264,140	Teheran	1,512,082
East Azerbaijan	2,112,134	Tabriz	289,996
Fars	1,107,619	Shiraz	170,659
Gilan	1,422,407	Rasht	109,491
Isfahan	1,342,169	Isfahan	254,708
Kerman	616,705	Kerman	62,157
Kermanshah	708,242	Kermanshah	125,439
Khurasan	2,023,612	Meshed	241,989
Khuzistan	1,290,175	Ahvaz	120,098
Kurdistan	490,244	Sanandaj	40,641
Mazandaran	1,188,316	Sari	26,278
West Azerbaijan	719,023	Rizaiyeh	67,605
<i>General Governorships</i>			
Bakhtiari-Chahar Mahal	340,612	Shahrkord	15,476
Hamadan	730,365	Hamadan	99,909
Luristan	564,987	Khorramabad	38,676
Oman Sea	240,289	Bandar 'Abbas	17,710
Persian Gulf	188,063	Bushire	18,412
Samnan	177,239	Samnan	29,036
Total	18,954,704		

Of the total population of over 22 million, more than half live in farming villages. Another fifth of the people lead nomadic or seminomadic lives as herders. The remainder—less than a third of the total—live in towns of 5,000 people or more. The greatest concentration of city dwellers is in Teheran.

Iranian society presents sharp contrasts. The people of the larger cities have adopted Western ways, while among the nomad herders tribal customs still prevail. Some parts of the country are almost totally isolated, and languages that are unrelated or only distantly related to Iranian (Persian) are spoken there. Gradually, however, the unifying force of education is reaching even the nomads. The country is also being more closely knit together by better communications and by the village cooperatives set up in the 1960's to assist peasant farmers to make better use of land they received in the reforms of the 1950's and 1960's. New industries have drawn many people to the cities, where traditional ways are giving place to Western customs.

In seeking to create a unified society, Iran has no need to develop a synthetic culture or history to bind its people together. The country has a continuous national history of almost 3,000 years. The Persian empire was one of the great empires of the ancient world. Persian art and literature were second to none in the Middle East, particularly during the period known in Europe as the Middle Ages. Islam is the religion of almost all the people. Although Persian is not the only language spoken, it is tending to prevail as the country is tied more closely together through expanding communications facilities and through the Iranian government's educational programs.

The process of unifying and modernizing Iran, begun by Reza Shah after World War I and continued by his son Mohammed Reza Pahlavi after World War II, is still in its early stages. It has been resisted, vehemently at times, by conservatives among religious and economically prosperous groups. But land reform and economic planning continue slowly to modify the traditional social pattern.

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See also separate articles on IRAN, LANGUAGES OF; PERSIAN ART; PERSIAN LITERATURE; PERSIAN MYTHOLOGY.

1. THE LAND

Over 90 percent of modern Iran lies on the Iranian plateau, which stretches from the Tigris-Euphrates river valleys on the west to the Indus Valley and Pamir "Roof of the World" on the east. In its eastern half, the plateau also comprises Afghanistan and Pakistani Baluchistan. This plateau is boldly outlined in the shape of the letter V by the high Zagros and Elburz mountain ranges. These ranges are tied together at the apex—in and beyond the province of Azerbaijan—in what the geographers call the "Armenian knot," to which are also connected the Anatolian and Caucasian mountains.



World Bank

Building roads in the mountains of Iran is an expensive undertaking, but vital to the country's development.

Mountains. The Zagros range of mountains, rising steeply from the Mesopotamian plain, runs southeastward parallel to Iraq and the Persian Gulf. Several peaks north of the head of the gulf reach more than 14,000 feet in height. The range then tapers off into the wastelands of Baluchistan opposite the Indian Ocean. The Zagros range, comprising the mountains of Kurdistan, Luristan, Bakhtiari, Fars, and Baluchistan, is generally rugged and wild, framing a pattern of longitudinal and transverse valleys that are sometimes lush but invariably require irrigation to support agriculture. Parallel to this main range, about 2,500 miles in length, runs an interior range of less height and breadth. Rising west of the Darya-yi-Namak, a great salt lake south of Teheran, it leaves Isfahan to the west, bypasses the towns of Yazd and Kerman to the east, and then joins the main range in Persian Baluchistan around the extinct volcano Kuh-i-Bazman, 11,470 feet in height.

The other rugged arm of the V—the Elburz range—runs eastward parallel to the Russian border. Rising steeply from the Caspian plain, it breaks down in Khurasan into minor ranges extending to the Amu Darya and the Hindu Kush; but south of the Caspian Sea it rises to 12,140 and 15,592 feet respectively, in the Sahand and Sava-lan peaks of Azerbaijan, and to 18,600 feet in Mount Demavend, Iran's fabled and highest mountain, to the east of Teheran. To the east, along the Iran-Afghanistan border, a broken transverse range runs from north to south where the outstanding landmark on the Baluchistan border is the peak Kuh-i-Taftan, 13,261 feet high.

IRAN and IRAQ

IRAN
Total Population 22,860,000

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Gilan (prov.), 1,422,407	F 2
Hamadan (governorate),	
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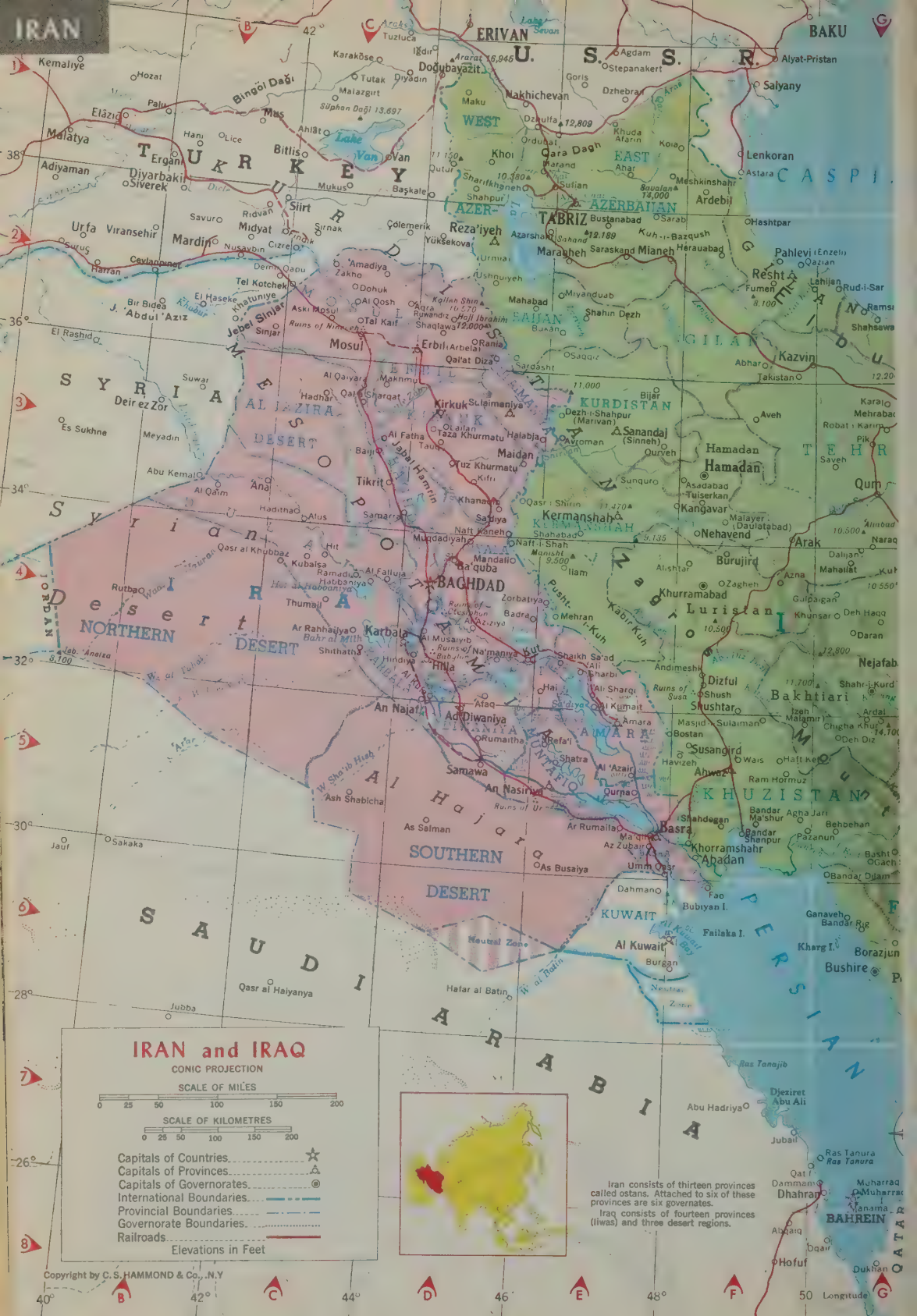
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Nehavend, 20,972	F 3
Nejafabad, 30,422	G 4
Nikshahr, 1,879	M 7
Niriz, 12,401	J 6
Nishapur, 25,820	L 2
Pahlevi (Enzeli), 31,349	F 2
Pak, 802	F 5
Pishin, 1,660	M 7
Qain, 4,414	L 4
Qasr-i-Shirin, 23,901	E 3
Qasrqand (Nikshahr), 1,879	M 2
Qazian, 3,054	F 2
Quchan, 21,250	L 2
Qum, 105,272	G 3
Qureh, 2,929	E 3
Qutur, 655	D 1
Rafsanjan (Bahramabad),	
9,212	K 5
Rai, 22,327	G 3
Ram Hormuz, 7,258	F 5
Ramsar, 1,105	G 2
Rask	M 7
Ravar, 5,074	K 5
Resht, 118,634	F 2
Reza'i'yeh, 67,605	L 2
Rigan, 8,255	D 6
Robat-i-Karim, 2,328	G 3
Rud-i-Sar, 7,460	G 3
Sabzawar, 30,545	K 2
Sabzawaran, 2,480	K 6
Samnan, 29,036	H 3
Sanandaj, 40,641	E 3
Sangi-Sar, 9,109	H 3
Sangun, 2,250	M 3
Saqiz, 12,729	E 2
Sarab, 13,086	E 2
Sarakhs, 3,461	M 2
Saraskand, 3,153	E 2
Saravan (Shahistan), 4,012	N 7
Sarbaz	M 7
Sardasht, 2,645	D 2
Sari, 26,278	H 2
Savanat (Estahbanat), 16,308	H 6
Saveh, 14,537	G 3
Sehkuh	M 5
Shahabad, 4,346	E 3
Shahdad, 2,777	K 5
Shadegan, 4,321	F 5
Shahi, 23,055	H 2
Shahin Dezh, 4,195	E 2
Shahistan, 4,012	N 7
Shahr-i-Kurd, 15,476	G 4
Shahriza, 29,311	H 4
Shahrud, 17,058	J 2
Shahsavar, 7,626	G 2
Shamli, 668	K 7
Sharifabad, 780	L 2
Sharifkhaneh, 1,260	D 1
Shiraz, 229,761	H 6
Shirvan, 6,906	K 2
Shush, 1,433	F 4
Shushtar, 18,527	F 4
Shuss, 497	L 5
Sib, 1,249	N 7
Sinneh (Sanandaj), 40,641	E 3
Sirik, 1,365	K 7
Sirjan, 12,160	J 6
Sivand, 1,811	H 5
Soh, 1,012	G 4
Sufian, 2,914	E 1

*City and suburbs. †Population of commune.

IRAN: Total pop.—1964 off. est.; cities over 100,000—1963 off. est.; other pops—1956 final census. IRAQ: Total pop.—1964 off. est.; provinces—1962 off. est.; cities over 100,000—1963 off. est.; capital (with suburbs) & cities under 100,000—1957 final census.





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Sultanabad (Kashmar), 13,299.....	L 3
Sunqur, 12,126.....	E 3
Susangird, 6,025.....	F 5
Tabas, 7,413.....	K 4
Tabas (Tabas-Masina), 466.....	L 4
Tabriz, 387,803.....	D 2
Taft, 6,451.....	J 5
Tajabad, 269.....	M 3
Takistan, 10,534.....	F 2
Tarum, 394.....	G 6
Urmia (cap.), 2,317,116.....	G 3
Tuiskeran, 11,323.....	F 3
Tun (Firdaus), 6,834.....	K 3
Turbat-i-Haidari, 19,830.....	L 3
Turbat-i-Shaikh Jam, 6,756.....	M 3
Turut, 721.....	F 2
Urmia (Reza'iyyeh), 67,605.....	D 2
Ushnujeh, 2,778.....	D 2
Veramin, 5,205.....	G 3
Wais, 2,424.....	F 5
Yazdan.....	M 4
Yezd, 63,502.....	J 5
Yezd-i-Khast, 3,544.....	H 5
Zabul, 12,221.....	M 5
Zagheh, 538.....	F 4
Zahidan, 17,495.....	M 6
Zarand, 4,099.....	K 5
Zarghan, 6,368.....	H 6
Zenjan, 47,159.....	F 2
Zuhrabad, 1,349.....	M 3

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Ab-i-Diz (river).....	F 4
Aji-Bala (mt.).....	E 5
Aji Chai (river).....	E 5
'Alibad (mt.).....	G 3
'Alijurg (mt.).....	G 5
Araks (river).....	D 1
Atrék (river).....	J 2
Bakhtegan (lake).....	J 6
Baluchistan (region).....	M 7
Bampur (river).....	M 7
Bazman (mt.).....	L 6
Bul (mt.).....	H 5
Caspian (sea).....	F 1
Chandir (river).....	K 1
Dalu (mt.).....	H 6
Daryay-i-Namak (salt lake).....	G 3
Dasht-i-Kavir (salt desert).....	H 3
Dasht-i-Lut (desert).....	K 5
Demavend (mt.).....	G 3
Dez (Ab-i-Diz) (river).....	F 4
Elburz Range (mts.).....	G 2
Faroum (mt.).....	K 6
Gabrig (river).....	L 8
Gamas Ab (river).....	E 3
Gavkaneh (lake).....	M 5
Hamun-i-Helmand (marsh).....	H 4
Hamun-i-Jaz-Murian (marsh).....	L 7
Hamun-i-Sabari (lake).....	M 5
Hanjam (isl.), 219.....	J 7
Hari Rud (river).....	M 3
Hashtadan (reg.).....	M 3
Hindarabi (isl.), 55.....	H 7
Hormuz (isl.), 2,569.....	K 7
Jabru Rud (river).....	L 2
Jagin (river).....	L 8
Kabir Kuh (mts.).....	E 4
Karat Kuh (mts.).....	M 3
Karkheh (river).....	E 4
Karun (river).....	F 5

Kashaf Rud (river).....	M 2
Khar (mt.).....	H 5
Khang (isl.), 647.....	F 6
Khusf Rud (river).....	L 4
Kuh-i-Ala Dag (mts.).....	K 2
Kuh-i-Bagraband (mts.).....	M 8
Kuh-i-Bazqush (mts.).....	E 2
Kuh-i-Dinar (mts.).....	G 5
Kuh-i-Gugird (mts.).....	H 3
Kuh-i-Jagatai (mts.).....	K 2
Kuh-i-Kaiat (mts.).....	L 4
Kuh-i-Kargiz (mts.).....	G 4
Kuh-i-Shah Jehan (mts.).....	L 2
Kur Rud (river).....	H 6
Kurang (river).....	G 4
Lalehzar (mt.).....	K 6
Larak (isl.), 208.....	K 7
Laristan (region).....	J 7
Maidan (cape).....	L 8
Makran (region).....	M 8
Mand Rud (river).....	G 6
Manisht (mt.).....	E 4
Mashkel (river).....	M 9
Mehran (river).....	J 2
Mihrahi (mt.).....	L 2
Namakzar (lake).....	M 4
Namakzar (dry lake).....	L 5
Nar (mt.).....	J 5
Nezwar (mt.).....	H 3
Nihing (river).....	N 7
Oman (gulf).....	M 8
Pasargadae (ruins).....	H 5
Persepolis (ruins).....	H 6
Persian (gulf).....	F 6
Pusht-i-Kuh (mts.).....	E 4
Qais (isl.), 760.....	J 7
Qal'eh-i-Mura (river).....	J 3
Qara Dag (mts.).....	E 1
Qara Su (river).....	E 1
Qara Su (river).....	G 3
Qara Su (river).....	K 2
Qaraneg (river).....	E 2
Qibla (mt.).....	J 6
Qishm (isl.), 2,356.....	J 7
Qizil Uzun (river).....	F 2
Rabch (river).....	L 8
Ruhkut (river).....	M 7
Sadaich (river).....	L 8
Safidar (mt.).....	H 6
Sahand (mt.).....	E 2
Savalan (mt.).....	E 1
Sefid Rud (river).....	F 2
Shaikh Shu'ab (isl.), 402.....	H 7
Shelagh (river).....	M 5
Shir (mt.).....	J 5
Shirvan (river).....	E 3
Shur (river).....	J 7
Siana Kuh (mts.).....	M 6
Silop (river).....	M 8
Sirri (isl.), 70.....	J 8
Susa (ruins).....	F 4
Taftan (mt.).....	M 6
Talab (river).....	N 6
Tashk (lake).....	J 6
Urmia (lake).....	D 2
Vajinanu (mt.).....	J 2
Yezd (region), 289,818.....	J 5
Zapros (mts.).....	E 4
Zarand Rud (river).....	H 4
Zarneh (river).....	E 2
Zenjan (river).....	F 2
Zilbir Chai (river).....	D 1
Zuhreh Rud (river).....	F 5

IRAQ	
Total Population 7,004,000	
PROVINCES	
'Amara, 337,314.....	E 5
Baghdad, 1,549,604.....	C 3
Basra, 576,115.....	E 5
Diwaniya, 499,984.....	D 5
Diyala, 359,462.....	D 4
Erbil, 285,489.....	D 2
Hilla, 385,016.....	D 4
Karbala', 308,854.....	C 4
Kirkuk, 430,666.....	D 3
Kut, 310,630.....	D 3
Mosul, 619,879.....	C 2
Nasiriyah, 474,228.....	E 5
Ramadi, 280,294.....	C 4
Sulaimaniya, 319,771.....	D 3
CITIES AND TOWNS	
Ad Diwaniya, 33,433.....	D 5
'Afaq, 15,842.....	D 4
Al 'Azair, 15,896.....	E 5
Al 'Aziziyah, 27,288.....	D 4
Al Falluja, 50,499.....	C 4
Al Faluja, 115,329.....	C 3
Al Kufa, 31,113.....	D 4
Al Kumait, 20,544.....	E 4
Al Musaiyib, 12,219.....	D 4
Al Qa'im, 16,854.....	B 3
Al Qaiyara, 31,069.....	C 3
Al Qosh, 14,344.....	C 2
Al Qurra, 4,124.....	E 4
'Ali Gharbi, 15,456.....	E 4
'Ali Sharqi, 8,398.....	E 4
Alus, 422.....	C 3
'Amadiya, 9,099.....	C 2
'Amara, 62,552.....	E 5
An Najaf, 125,424.....	D 5
An Nasiriyah, 39,239.....	D 5
'Ana, 15,729.....	B 3
'Aqra, 6,041.....	D 2
Ar Rahhalayah, 1,579.....	C 4
Ar Rumaila, 1,439.....	E 5
Arbela (Erbil), 39,913.....	D 2
As Busaiya, 2,136.....	E 5
As Salman, 3,584.....	D 5
Ash Shabicha, 37,679.....	C 5
Aski Mosul, 643.....	E 5
Az Zubair, 35,550.....	E 5
Badra, 6,506.....	D 2
Baghdad (cap.), 410,877.....	D 4
Baghdad, *784,763.....	D 4
Baiji, 13,602.....	C 3
Barquba, 56,616.....	D 4
Basra, 175,678.....	E 5
Dohuk, 7,680.....	C 2
Erbil, 39,913.....	D 2
Fao.....	F 6
Habbaniya, 35,113.....	C 4
Hadhar, 17,726.....	C 3
Haditha, 17,589.....	C 3
Hai, 45,205.....	E 4
Halabja, 23,478.....	D 3
Hilla, 72,943.....	D 4
Hindiya, 12,709.....	D 4
Hit, 23,297.....	C 4
Karbala', 60,294.....	C 4
Khanagiri, 19,797.....	D 3
Kifri, 5,771.....	D 3
Kirkuk, 120,593.....	D 3

Kirkuk, *176,794.....	D 3
Kubaisa, 4,023.....	D 4
Kut, 71,360.....	D 4
Lailan, 1,079.....	D 3
Maidan, 7,939.....	D 3
Makhmur, 6,580.....	C 3
Mandali, 37,189.....	D 4
Ma'qil, 12,362.....	E 5
Mosul, 215,882.....	D 4
Muqaddiyah, 33,031.....	D 2
Naft Kaneh.....	D 3
Na'maniya, 29,088.....	D 4
Qal'a Sharqat, 35,367.....	C 3
Qal'at Diza, 16,275.....	D 2
Ramadi, 55,971.....	C 4
Rania, 18,763.....	C 2
Refai, 42,954.....	E 5
Rumaiha, 44,478.....	D 5
Rutba, 11,025.....	B 4
Ruwandiz, 26,798.....	D 2
Sa'diya, 16,816.....	D 3
Samarra, 49,940.....	C 3
Samawa, 27,010.....	C 3
Shaikh Sa'ad, 11,337.....	E 4
Shaqalawa, 4,196.....	D 2
Shatra, 50,056.....	E 5
Shithatha, 2,083.....	C 4
Sinjar, 37,155.....	B 2
Sulaimaniya, 48,812.....	D 3
Tal Kaif, 27,148.....	C 2
Taza Khurmatu, 12,179.....	D 3
Tikrit, 21,702.....	C 3
Tuz Khurmatu, 38,280.....	D 3
Umm Qasr, 857.....	E 5
Zakho, 8,033.....	C 2
Zorbatia, 3,503.....	D 4

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Adhaim (river).....	D 3
'Aneiza, Jebel (mt.).....	A 4
'Arab, Shatt'al- (river).....	F 5
'Ar'ar, Wadi (dry river).....	B 5
Babylon (ruins).....	D 4
Batin, Wadi al (dry river).....	E 6
Ctesiphon (ruins).....	D 4
Dalmaj, Hor (lake).....	D 4
Diyala (river).....	D 4
Euphrates (river).....	D 4
Great Zab (river).....	C 2
Habbaniya, Hor (lake).....	C 4
Hajara, Al (plain).....	D 5
Haji Ibrahim (mt.).....	D 2
Hammar, Hor al (lake).....	E 5
Hamrin, Jabal (mts.).....	D 4
Hauran, Wadi (dry river).....	B 4
Kalleh Shin (mt.).....	D 2
Kurdistan (region).....	C 2
Little Zab (river).....	C 3
Mesopotamia (region).....	B 3
Milh, Bahr al (lake).....	C 4
Nineveh (ruins).....	C 2
Sa'diya, Hor (lake).....	E 4
Saniya, Hor (lake).....	E 5
Sha'ib Hisb, Wadi (dry river).....	C 3
Sinjar, Jebel (mts.).....	B 2
Susaiqiya, Hor as (lake).....	D 4
Syrian (desert).....	B 4
Tharthar, Wadi (dry river).....	C 3
Tigris (river).....	C 2
Tubal, Wadi al (dry river).....	B 4
Ubaidiyah, Wadi (dry river).....	B 5
Ur (ruins).....	D 5

Deserts. Between these ranges, in the center of Iran, are the great deserts, between the Elburz range and Baluchistan: the Dasht-i-Kavir to the northwest and the Dasht-i-Lut to the southeast, separated by a series of oases. One of these oases, Tabas, is one of the most luxuriant creations of nature in all Iran. Part of its fame and the fame of Persian gardens in general is due to the contrast between the fertile land and the surrounding desert. The desert area of Iran, in which most of the country's interior drainage is lost, is one of the worst of Asia's wastelands, sustaining scarcely any life.

Coastal Regions. To the south and north of the mountain ranges forming the Iranian V are the Persian Gulf and Caspian coastal areas, so different in terrain and climate from the Iranian plateau. At the head of the Persian Gulf is the plain of Khuzistan, where the first Iranian kingdom of Elam arose and where the chief Iranian oilfields are located. Temperatures rise to 130° F, and high humidity adds to the discomfort. Similar climatic conditions characterize the narrow coastal plain of the Persian Gulf and Indian Ocean where only a few poor harbors can be found. In the north, on the Caspian littoral, which is below sea level, the climate is subtropical and the vegetation lush. The northern Elburz slopes are heavily wooded. Here the rainfall may exceed 60 inches a year, whereas on the high plateau, averaging 4,000 feet, the rainfall ranges from 6 to 7 inches in the center and south to as much as 35 inches in northwest Azerbaijan, the average being less than 12 inches. Most precipitation on the plateau falls between November and April. The moisture comes from the Mediterranean and Caspian seas, and descends usually as snow on the mountains, often remaining until midsummer. The water from melting snows moves to the plains and valleys in streams, on the surface and underground, to sustain crops and gardens. On the plateau the summers are clear and warm by day, the winters cold. In Teheran, located at an altitude of 3,800 feet, the temperature range is from 5° to 110° F.

Rivers. Roughly, the country has four drainage systems: Lake Urmia (Rizaiyeh) in Azerbaijan, the Caspian, the Persian Gulf, and the central desert. Short streams flow from both the Elburz and Zagros ranges into slowly shrinking Lake Urmia, which is about the size and salinity of the Great Salt Lake of Utah in the United States. The Aras (Araxes) River, which separates Persian Azerbaijan from Soviet Azerbaidzhan, flows into the Caspian Sea from the west. The Atrek and Gorgan rivers flow into the Caspian from the east, the former making a border for part of the way with the Turkmen Soviet republic. From the south, several small streams flow down the central Elburz into Mazanderan (the Chalus, the Haraz, and the Lar). To the west there is a large stream which, after rising on the western plateau as the Qizil Uzun and turning eastward, is joined by the Shah Rud, which drains the central Elburz behind Kazvin and Teheran; it then breaks through the mountain wall at Menjil and reaches the Caspian as the Sefid Rud, whose delta is the heart of Gilan province.

The largest river of Iran, the Karun, navigable for some 70 miles, is joined on the Khuzistan plain by the Ab-i-Diz and Karkheh. These drain the central western Zagros to the Shatt-al-Arab at the head of the Persian Gulf; the southeastern reaches of this range are drained by

small precipitous streams into the Persian Gulf. The inside slopes of the Zagros and Elburz ranges are drained by streams flowing to the central marshes and deserts, where much of their water, abundant during spring and early summer, is lost. Among these are the Jaj Rud, Karaj, and Kan near Teheran; the Qara Su near Hamadan; the Qum flowing near the shrine city of the same name; the Hableh east of Kashan; the Kur flowing past Persepolis; and the Zayendeh (Zaindeh) Rud, the largest of these, which waters Isfahan and its extensive plain. In 1953 the Zayendeh was enlarged by a tunnel connecting it with the headwaters of the Upper Karun. To the east, a part of the province of Seistan is fed by the Helmand, which flows into Helmand Lake (Hamun-i-Helmand) from the western Hindu Kush in Afghanistan. Its control has been a matter of dispute between Afghanistan and Iran.

Plants and Animals. Iran's variety of climate and rainfall causes uneven distribution of plant and animal life. In the central saline marshes and deserts there is less life than anywhere else in Asia, while on the subtropical Caspian littoral the forms of life are legion. On the northern Elburz slopes up to 6,000 feet are found the walnut, oak, maple, beech, ash, elm, cypress, cedar, honey locust, boxwood, and mimosa. On the plateau, the willow, walnut, tall poplar, mulberry, and plane tree are the most common. Seed-bearing plants—such as cotton, linseed, sesame, castor, and poppy—furnish oils. Wild plants and shrubs—such as gum arabic, tragacanth, asafetida, galbanum, colocynth, and licorice—produce valuable saps or resins. Vegetable dyes come from indigo, henna, saffron, and gallnuts. Many flowers are native to Iran—the tulip, rose, gladiolus, grape hyacinth, bellflower, gentian, poppy, geranium, crocus, primrose, violet, iris, pink, buttercup, cyclamen, hollyhock, jasmine, and honeysuckle.

In the Elburz forests there are tigers, leopards, wild boars, brown bears, stags, and lynx; foxes, panthers, wolves, jackals, and deer are widespread, as are porcupines, squirrels, hares, rats, and mice. Wild asses in the salt deserts, gazelles on the plains, wild sheep and goats on the mountains, and wild boars in swampy places attract hunters. Reptiles, turtles, lizards, and snakes abound, but only scorpions, tarantulas, and horned vipers of southern Iran are poisonous. Birds include the crow, raven, vulture, falcon, magpie, oriole, jay, sparrow, finch, lark, wagtail, warbler, thrush, robin, woodpecker, owl, heron, stork, quail, pheasant, partridge, pigeon, turtledove, duck, chicken, goose, and turkey. In the rivers of the Caspian littoral a variety of fish, such as sturgeon, salmon, carp, trout, and pike, flourish.

2. THE PEOPLE

Peasant village culture on the Iranian plateau goes back to Neolithic times, but the nature of the aboriginal stock is not clear. The indigenous inhabitants in the region of the Zagros Mountains were conquered around 1500 B.C. by the Aryans, who constitute the Indo-Iranian branch of the Indo-European-speaking family of peoples. Augmented by later Median and Persian incursions, they created a culture that has persisted for 3,000 years. To this group, besides the Persians, belong the Afghans, the Tajiks (Tadjiks), and the Kafirs of Kafirstan between the Hindu Kush and Kashmir.

Racial Stocks. The modern Iranian is racially the result of several thousand years of blending. The aboriginal groups mixed with the successive Aryan invaders and also with Central Asian peoples—the Parthians, Turks, and Mongols. In addition, the people of the Iranian plateau interbred to some extent with Westerners—the Aramaeans, Greeks, and Arabs. The purest types are probably to be found among the mountain tribes, such as the Kurds, the Lurs, and the Lakhs of Fars; among the endogamous Zoroastrians of Yezd and Kerman; and among the more isolated peasants less affected than townspeople by successive waves of invasion and conquest.

In Khuzistan, often called Arabistan, there are many Arabs, as there also are up and down the Persian Gulf coast. North of a line from Lake Urmia (Rizaiyeh) through Hamadan and Qum to the Russo-Afghanistan border, a large number of Turks are found, all speaking Turkish dialects, mostly Azeri (Azari). In the northeast, in Mazanderan, Gurgan, and parts of Khurasan, there are Mongoloid types, with high cheek bones, slant eyes, and sparse beards. The Baluchi of the southeast seem to be related to the old Dravidians of India. Among them are traces of Negroid characteristics, which has led some scholars to infer that the whole Makran coast of Baluchistan was once closely connected with East Africa through southern Arabia.

From 60,000 to 70,000 Armenians are found in Azerbaijan and Isfahan, and in the cities of Tabriz, Hamadan, Resht, Teheran, and Isfahan. The Nestorians, or Syriac-speaking "Assyrians," were once concentrated on the western shores of Lake Urmia. Reza Shah Pahlavi, who reigned from 1925 to 1941, took steps to consolidate them in cities in the north, particularly in Kermanshah, Hamadan, and Teheran. Despite considerable emigration to America, they probably number about 30,000 to 35,000 in Iran today. Some 40,000 Jews, the origins of whose community go back to Neo-Babylonian and Achaemenid times, live in the northern cities of Hamadan, Resht, and Teheran.

The Persian people today display a mixture of physical characteristics. Some are "Alpines," others have Mediterranean features and build, and still others have Mongoloid features. The people are usually medium in stature and slight of build, with dark hair and complexion, and brown or black eyes. Some of the women have fair complexions, with moon-shaped faces, delicate features, and large dark eyes sheltered by long lashes—the classic type of beauty in Persian romantic literature.

Nomadic Tribes. The tribes of Iran successfully resisted the efforts of Reza Shah to settle them on the land, although among them there have long been semisedentary elements. The tribes are virile, proud, and independent. They have often been the rulers of the land and have been accustomed to contribute their best warriors for its defense. They raise horses, cattle, and sheep, and perform an important economic function by producing meat, wool, hides, casings, and milk products from vast areas unfit for cultivation. Between them and the sedentary peoples there has always been a gulf of suspicion, if not of enmity—a clash of differing ways of life and patterns of values. One of the pressing problems of modern Iran is the fruitful integration of these long-neglected but strong and virile groups into the common life of the nation.

The largest and most distinctive of the tribes



Davis Pratt, Rapho-Guillumette

Mongoloid-featured Turkoman tribesmen hold a weekly bazaar 10 miles south of the Soviet Turkestan border.

are found in the Zagros Mountains. In the northwest part of the mountains are the Kurds, between Rizaiyeh and Kermanshah, numbering about 750,000. They are fiercely independent in their mountain fastnesses, where they have lived for at least 3,000 years. To the south of Kermanshah and Hamadan are the Lurs, related to the Kurds and, like them, residents of these mountains for several thousand years. Some 3,000 years ago the Kassites lived in this area. The beautiful Luristan bronzes are still being exhumed from their cemeteries. (See PERSIAN ART—*Bronze and Early Iron Age*.) Farther south, west of Isfahan and north of Shushtar, are the various branches of the Bakhtiari, a loose confederation related to the Lurs. Occupying some of the finest, most luxuriant, and picturesque mountain valleys of the whole country, nomadic branches of the tribe still trek long distances to pasture their stock in the highlands—a trek that was followed by Merian C. Cooper and his party in 1924, and dramatically recorded in the film and book entitled *Grass*. The Bakhtiari have often played a leading role in modern Persian history; the father of Mohammed Reza Shah's second wife, Soraya, was one of their chieftains.

The languages of these Zagros mountain tribes are Iranian, related to older forms of Persian. Farther south, in the mountains of Fars, are the Turkish-speaking Qashqai, many of whom migrate in the summer some 300 miles from around Firuzabad, south of Shiraz, northward to the borders of Isfahan province. Often allied to the Qashqai are the nearby Boir Ahmadi and Arab tribes, some of whom dominate parts of Khuzistan. In the southeast are the Baluchi tribes. In the Elburz Range in the north are to be found the various Turkoman tribes, who formed the basis of Safavid power in the 16th century. They are now largely absorbed into the sedentary life of the country, but some are still identifiable and active, such as the Shahsavan around Ardebil, the Zolfagari near Zenjan, and the Turkomans of Gurgan and Khurasan.

Language. The official language of Iran is Persian. Although it is written in Arabic char-

acters, it belongs to the Indo-European rather than the Hamito-Semitic family of languages. In its modern form it was reborn in Khurasan under the Samanids (874 A.D.-999), following the Arab conquest of 300 years before. So little has the language changed in the last 1,000 years that the epic *Shah Nameh* of Firdausi, written about 1000 A.D., is still understandable to the majority of the people, even though it is almost pure Persian as compared with the current speech, which has many Arabic words and phrases. Modern Persian can be traced back through Pahlavi, or Middle Persian, of the Parthian-Sassanid era to the Old Persian of the Achaemenids and to the Avestan of the Zoroastrian scriptures; and beyond these to Sanskrit, to which Old Persian and Avestan are closely related. Azeri Turkish is spoken widely over the northern half of the country, while in isolated valleys and separated provinces there are scores of vernacular dialects related to Persian at various stages of its development. See also IRAN, LANGUAGES OF.

Religion. Approximately 98 percent of all Iranians profess Islam, the official religion. Most of them belong to the Shi'ite sect, the minority branch of Islam. Kurds, Turkomans, and Arabs adhere to the majority branch of Islam, the Sunnite sect.

The Shi'ite branch of Islam is itself split into many sects. One of these is known as the Twelvers because they believe that the 12th imam (the 12th descendant of Mohammed beginning with his son-in-law Ali) is in hiding but will one day reappear as the Mahdi to usher in a period of universal Islam, peace, and prosperity. The Twelvers sect became Persia's official religion about 1500. The shah was considered the hidden imam's deputy and claimed descent from Ali. The crown continued to be closely associated with Islam until the secularizing reign of Reza Shah Pahlavi. Although there was a religious resurgence after 1941, the old Shi'ite fanaticism appeared to have lost its grip.

Sufism, the mystic form of Islam, was the philosophical religion of the Persian poets. Though long eclipsed and persecuted by Shi'ism, it has increased its influence, in a modernized form, especially among the educated and nationalistic youth.

Bahá'ism, another offshoot of Shi'ite Islam, was founded by Iranians in the 19th century. The Bahá'is and their predecessors, the followers of Mirza Ali Mohammed (known as the Báb), were severely persecuted by the Persian government. (See section 6. *History: The Kajar Dynasty and Foreign Influences.*) The influence of Bahá'ism within the country is less today than it was in the 19th century. The Bahá'is are not recognized by the law as forming a legitimate religious community.

Only about 20,000 Zoroastrians remain in the country as representatives of the classic religion of pre-Islamic Iran. Long persecuted and mostly confined to Yazd and Kerman, they are now honored by many who revere the nation's ancient traditions.

The Christian minority, numbering more than 100,000, consists mainly of Armenian Orthodox and Nestorians, with smaller numbers of Greek Orthodox, Roman Catholics, and Protestants. There are about 40,000 Jews. All these are recognized religious communities and are accorded religious freedom by law.

Marriage and the Status of Women. Though Islam permits polygamy, polygamy is on the wane in Iran, primarily because it is not economically feasible for most men to support more than one wife. Islam also allows temporary marriage, and divorce is relatively easy to obtain. Most marriages are arranged by the heads of families, since the family is still a powerful institution in Islamic society.

Women were protected to a degree in the past by the dowry, an institution that today is disappearing. But beginning with the legal reforms of 1925-1928, women's legal and political position

A village public bath near the Caspian Sea. Each village has a community bath, generally built by the local landowner.

Marion Wolcott, Pix



has greatly improved in other ways. In 1963 they were given the vote and allowed to run for office. With the discarding of the veil in 1935-1936, women also began to take advantage of opportunities for education and careers.

Conservative religious forces have been opposed, sometimes violently, to these changes in the status of women, and by and large the women themselves have been slow to avail themselves of the new freedoms. The great majority of them still marry young, preferring their traditional role to the "emancipated" role for women.

Dress, Food, and National Pastimes. Reza Shah's social reforms in the 1920's affected dress as well as other customs. In the 1920's the tarboosh (fez) worn by men gave way to the Pahlavi hat, a visored modification, which in the 1930's was replaced by the Western soft felt hat. In the cities, Western styles in clothing replaced the ancient Iranian style of dress. Following Reza Shah's abdication in 1941, many women returned to the veil. Village and tribal dress is still colorful and distinctive, although it too has been influenced by Western fashions.

The cuisine of Iran is deservedly famous, perhaps the best in western Asia. The diet of the peasant is frugal but on the whole balanced: bread, cheese, *mast* (thick soured milk), eggs, vegetables, raisins, nuts, dried fruits (fresh in season), and, on rare occasions, meat and fowl. A great variety of *dolmehs* or *dolmas* (vegetables stuffed with a mixture of meat, rice, and herbs), preserves, pickles, sauces, and stews adorn the tables of the middle and upper classes, along with pilaf (rice cooked with meat, vegetables, or spices). An endless variety of sweets are served. The national drink is tea, served in tiny glasses; it is the inevitable conclusion of a meal or accompaniment of conversation—business or pleasure. Hospitality is proverbial and calls for the best that one has, whether bread and cheese in the nomad's tent or the rich profusion of the landlord's or prince's table.

Both sexes smoke, generally cigarettes, although many still enjoy the old-fashioned *galyan*, or water pipe. Opium smoking, although now illegal, is still common, especially in certain sections of the south.

Conversation, including storytelling and versifying, and "taking the air" at sundown are favorite pastimes. Every village has its public bath and its teahouse where men gather to talk.

The *zurkhaneh*, or gymnastic center, flourishes throughout the country. Dating back to the remote past, it has in the 20th century been the training ground for the Iranian Olympic champions in wrestling and weightlifting. Iran is also the birthplace of the game of polo.

Picnicking is a universal custom. On Fridays, the weekly holiday, Iranian families often go to the country to picnic in shaded gardens. This becomes almost a national rite on the 13th day of the Muslim New Year, which brings to a close the national holiday festival at the time of the spring equinox.

3. ECONOMY

Once a great imperial power, Iran today is an agrarian and oil-producing country striving to enter the industrial age. Since World War II, it has built dams for power and irrigation and has established factories to process local raw materials so that the country would be less dependent on imports. It has improved and expanded its transportation network to facilitate the flow of goods within the country.

Nevertheless, industrialization in Iran is still in its infancy, and most Iranians continue to earn their living by farming, by herding, or in cottage industries such as rug making.

Agriculture. Though Iran is primarily an agricultural country, only about 11 percent of the land is arable. About 12 percent is forested, and 25 percent is in pasture and range. The rest is mountainous or desert, not suitable for cultivation. Of the 11 percent of arable land, one third is planted, while two thirds lie fallow.

The chief cereal crops are wheat, barley, Indian corn, and rice. These used to be grown in sufficient quantity to satisfy domestic needs, and there was sometimes a surplus of wheat and barley for export. Now wheat must be imported. Practically all the vegetables, fruits, melons, and nuts known in the West are cultivated in Iran. Fruits and nuts are among the most important agricultural crops for export. They include the famous melons of Isfahan, peaches and cherries of Meshed, grapes of Shiraz, apricots of Hamadan, pistachios of Kerman, and almonds of Azerbaijan. Citrus fruits abound along the Caspian. Dates are grown in the oil province of Khuzistan and in the warmer regions on the Persian Gulf.

Cotton is Iran's principal cash crop. It is grown in the Caspian Sea provinces, which also

A tobacco crop is cured in a village near the Caspian Sea. This variety is used in making Turkish tobacco for cigarettes.

Davis Pratt, Rapho-Guillumette





Iran: Principal cities, products, and resources.

produce tobacco, tea, and raw silk. Sugarcane and sugar beets are raised, but not in large enough quantities to meet domestic needs. Cultivation of the poppy has been prohibited since the suppression of the opium trade in 1955.

Irrigation is necessary throughout most of Iran. Only the lush Caspian plains and the dry-farming regions of Azerbaijan and Khurasan have adequate water without irrigation. Near the streams and rivers, water can be brought across the land surface to the croplands. In other areas it is necessary to use long and expensive underground channels or aqueducts, which tap the seepage from the mountains and bear it to fertile soil. This method probably dates back to prehistoric times.

The building of dams for irrigation and power has been given high priority in the government's post-World War II development plans. The Karaj Dam, west of Teheran, begun in 1958 and completed in 1961, irrigates the farmland south of the capital. The Sefid Rud has been dammed to irrigate 600,000 acres, and the Dez Dam in Khuzistan, built to restore the province's position as an important grain-producing area, was dedicated in 1963.

Land Reform. Until after World War II, about 80 percent of the land and the villages was owned by absentee landlords, religious groups, and

the crown, or was in the public domain. In 1950 the shah began distributing crown lands to peasants, who were to pay for the land over a 25-year period. In 1958 the government began distributing the 10 million acres of public land. When the large landowners failed to follow suit, the government decreed in 1962 that each landowner owning several villages must give up all but one. He was required to sell the rest to the state for resale to the peasants, who could pay for the land over a 15-year period. Two years later, landlords with small holdings of one village or less were required to give up some of their land, retaining a maximum of 75 acres to 370 acres, depending on the region. The state outlawed sharecropping and required landlords to pay money wages to their farmers.

Distribution of the holdings of the large landowners proved less troublesome than the breaking up of the holdings of the approximately 100,000 landlords owning one village or smaller tracts. These small landlords, who owned over half of Iran's agricultural land, faced economic ruin because the land reform law eliminated the source of much of their income.

A second problem that faced the reformers was how to instruct the illiterate peasantry in modern farming and marketing techniques. To meet the problem, the government established farm co-

operatives. But the country had almost no experience with cooperatives, especially for credit and marketing, and there was a shortage of skilled personnel who could give advice on such matters as scientific land use, irrigation methods, soil improvement, the handling of modern equipment, use of pesticides, and other phases of scientific farming. It became increasingly apparent that the redistribution of the land was only the first, and in some ways the easiest, stage in the agricultural revolution.

Herding, Fishing, and Forestry. The nomadic tribes of Iran raise sheep, cattle, horses, goats, asses, and camels. Though herding is done on an extensive scale, meat is relatively expensive. It is a rare luxury for most, who depend upon milk products, eggs, and nuts for proteins.

Fishing is a minor industry, carried on mostly with primitive equipment. The caviar industry is important, however. Iran is the world's chief supplier of caviar, taken from the Caspian Sea sturgeon.

There are valuable forests along the northern slopes of the Elburz mountain range, which rises from the southern coast of the Caspian Sea. The rest of the country has been almost denuded of trees by nomads and peasants using the wood for fuel, and by animals grazing on the new shoots. Reforestation was begun in 1956, and in 1963 nationalization of the forests was approved in a national referendum.

Petroleum and Other Minerals. Iran earns more foreign currency from the sale of crude and refined oil than from any other item of export. The total production of oil in the country has risen steadily since the first well went into production in 1908. Oil production increased from 237,807,500 barrels in 1950 to 605,844,646 barrels in 1964. Iran ranks sixth among the world's producers of oil, stands fourth in the world as an oil exporter, and accounts for about 10 percent of the world's oil reserves.

The major oilfields are located in the province of Khuzistan at the head of the Persian

Gulf. These fields are connected by pipelines to the large refinery on Abadan Island in the Shatt al-Arab delta. Abadan refines only about 25 percent of the oil produced. The remainder is shipped as crude oil to consumer countries—such as Britain and Australia—that have more refineries than Iran.

The petroleum industry was nationalized in 1951. When the government found it impossible to produce and market oil without foreign technical aid and international marketing cooperation, the government-owned National Iranian Oil Company (NIOC) and a consortium of foreign companies signed an agreement in 1954, under which the foreign companies were to operate the oilfields in the original concession area for 25 years. (See section 6. *History*: Nationalization of the Petroleum Industry.) Subsidiary companies were formed to market the oil.

Foreign companies and the NIOC as partners operate the offshore fields in the Persian Gulf. The NIOC controls the oil industry in all other parts of the country. It operates fields near the Iraq border in Luristan province and at Qum, 75 miles southwest of Teheran. The Qum strike was made in 1956, and the field went into operation in 1961. But these fields produce only a very small amount compared with the petroleum yields in Khuzistan.

Iran has substantial reserves of natural gas, but most of this resource has in the past been flared at the oilfields rather than used as a source of power.

Iran mines some coal, iron, chrome, and lead. There are small deposits of other minerals, but these have not been adequately surveyed. Building materials—such as stone, limestone, and gypsum—are widely quarried, and marbles and alabaster are available. Near Nishapur, fine turquoises have been mined for centuries.

Manufacturing. The industrialization of Iran, which dates from World War I, has developed primarily in and around Teheran. The capital has factories for the manufacture of matches, cement, shoes, jute, munitions, furniture, building materials, and plastic and rubber products. Vegetable-oil and soap factories and tobacco-processing plants are also located at Teheran. Only a few of these employ more than 500 workers.

The textile factories of Iran, which produce woolen, cotton, and silk cloth, are largely centered in Isfahan and Mazanderan. There are fish and caviar canneries on the Caspian Sea and Persian Gulf coasts, and vegetable and fruit canneries in the northern part of the country. Several large sugar refineries operate in the central plateau region. A dozen cities have rug factories with hand-operated looms. Many of the country's rugs are woven in the winter by the peasants.

Labor. Prior to industrialization, all labor was organized in crafts and guilds. For many local products this system still prevails.

Labor unions first became legal in Iran during World War II. In 1942 the Tudeh party—later revealed as Communist-controlled—sponsored the Central Committee of Trade Unions, which organized local unions in industrial centers. By political pressure and strikes, the unions succeeded in improving working conditions for the fast-growing number of industrial workers.

In 1946 the ministry of labor issued regulations for labor unions and managed to absorb some of the unions into the government-sponsored

Sturgeon, taken from the Caspian Sea, is opened, and caviar, its precious roe, is carefully removed.

Dalmas, Pix





World Bank

The Dez Dam was built in 1963 to provide enough water for irrigation to restore Khuzistan as a great grain center.

Union of Iranian Workers. Thereafter the government intervened on several occasions to compel management to satisfy labor's demands. In 1961 the government announced that factory owners would be required to build homes for their workers. Two years later, in order to provide incentives for greater productivity, the government decreed that contracts should be drawn up by labor and management permitting the workers to share in the company's profits. At the same time the right of collective bargaining was affirmed. However, this imposing series of labor laws was only rarely enforced in the succeeding years.

Power. The power needs of Iran's industries have greatly exceeded the amount of power available. To help overcome the shortage in Teheran, where about half of the country's industrial plants are situated, an oil refinery and natural gas complex were developed in the 1960's at Qum, a town near the capital. In order to increase the output of hydroelectric power, the government made the construction of large multipurpose dams a major goal of Iran's post-World War II development programs.

Foreign Trade. Iran's economy has suffered consistently from an unfavorable balance of trade. The chief exports are crude and refined petroleum and petroleum products, which account for about two thirds of the value of the country's exports. Other exports are raw cotton, carpets, and dried fruits and nuts. Iran has continued to depend on more industrialized countries for machinery, manufactured goods, industrial raw materials, and chemicals and pharmaceuticals. It also imports staple foodstuffs, such as sugar, to make up for deficiencies in its own agricultural output.

West Germany, the United States, and Britain have been important to Iran as both suppliers and purchasers. The Soviet Union provides another market for Iranian goods. In the 1960's Iran began to import goods from Japan.

Transportation. Because the lack of good roads seriously hampered the economic development of the country, road building was given a high priority in the postwar development plans. By the 1960's, however, less than one fifth of the

roads in Iran were asphalted. Very few of them were suitable for heavy trucking, and Iran had difficulty in maintaining the roads over the country's rugged terrain.

The country was first traversed by rail in 1938 when the city of Bandar Shah, situated on the Caspian shore near the boundary with the Soviet Union, was connected with the Persian Gulf ports. This difficult engineering feat took 10 years to complete. East-west extensions of the line were begun shortly before World War II. By 1957 the railroad had reached the Soviet border north of Tabriz. In the following years construction proceeded on a railroad link between Tabriz and Turkey, a project that was sponsored by the Central Treaty Organization (CENTO), to which both Iran and Turkey belong. A line was also constructed from Teheran to Meshed in the northeast and one was projected to West Pakistan through Yazd, Kerman, and Zahidan.

The island of Abadan is the chief port for the shipment of refined oil and petroleum products. Crude oil is shipped from Bandar Mashur and also from Kharg Island, to which the oil is pumped through a 25-mile underwater pipeline. Other goods are shipped out of the country primarily through the port of Khorramshahr on the Karun River at the head of the Persian Gulf. Other Persian Gulf ports are Bandar Shahpur, Bushire, and Bandar Abbas across from Oman. Trade with the USSR is through the Caspian ports of Pahlavi, Chalus, and Bandar Shah.

Most foreign passenger travel and mail is by air. Internal air traffic is a monopoly of the Iranian National Airlines, which is 50 percent government owned.

Currency. The treasury issues the rial as the standard monetary unit. Silver coins of 1, 2, 5, and 10 rials are minted, and there are bronze coins of 50 dinars (100 dinars = 1 rial). The monetary system provides for gold coins of one pahlavi and one-half pahlavi, but these are not in circulation. Bank notes range from 10-rial notes to 1,000-rial notes. Par value of the rial in 1965 was 75.75 to the U.S. dollar.

The monetary and banking law of 1960 required that at least 40 percent of the total note issue must be backed by gold and foreign currencies. Although their monetary value is incalculable, the royal jewels and treasures on deposit in the National Bank in Teheran are of psychological value in backing the currency.

4. EDUCATION AND MASS COMMUNICATIONS

Iran's entry into the industrial age has been hampered by a low degree of literacy. Only about 15 percent of the population can read. As one might expect, the rate is much higher in Teheran and the other large cities, while it is much below the national average in the peasant villages and among the tribes. In order to meet the problem of illiteracy, a law was enacted in 1943 making elementary education (through grade six) compulsory and free for all, both boys and girls. The law, however, is still an ideal rather than a fact, since the number of teachers has been wholly inadequate for this vast job and there have not been sufficient funds to construct the necessary schools. Illiteracy among the nomadic tribes has proved to be the most difficult to eradicate. It has remained virtually untouched by the law, although efforts to teach them to read are being made through itinerant teachers who move with the tribes.



Chapelle, Monkmeyer

A shortage of teachers and the remoteness of many Iranian villages have hampered efforts to raise the literacy rate.

Schools. By the mid-1960's approximately 50 percent of elementary school-age children were in school. This percentage represents a great improvement over the 1950's. Whereas in 1950 there were about 2,000 elementary schools with 264,000 pupils and 8,000 teachers, in 10 years these numbers had increased fivefold. In order to accomplish this advance in education, the number of teachers colleges was increased from the 25 opened by 1934 to 66 in 1960. The itinerant school system for the tribes was inaugurated in 1955, and 7 teachers colleges were established to train teachers for them.

Secondary schooling is neither compulsory nor free, and relatively few go on to these grades. In 1950 there were 455 secondary schools with about 27,000 pupils; by 1960 the number of schools had doubled. However, the number of secondary school teachers jumped from 1,700 in 1950 to 11,000 in 1960, and the number of students rose to 280,000. During this period, the stress was shifted in the secondary schools from college preparatory work to vocational training. The change in goals was paralleled by an increase of technical schools, which rose to about 70.

A beginning was made in developing literacy among adults by establishing evening classes and part-time day schools, especially in rural areas. Literacy programs were also instituted by the armed forces. At the same time, the shah's 1963 education program instituted a "literacy corps" of high school graduates exempted from military service. Members of the literacy corps are assigned to villages to teach village children to read and write. Though improvements were discernible, the goal of compulsory primary school education for all was far from being realized. It proved difficult to attract the required number of people to the teaching profession because of low pay. Teachers were so poorly paid that they had to resort to strikes to gain even a living wage.

The government established the University of Teheran in 1934. Its student body of 15,000 is divided among the faculties of arts, education, agriculture, fine arts, science, technology, medicine, dentistry, pharmacy, veterinary medicine, and

law. There are also universities in Tabriz, Shiraz, Meshed, and Isfahan. For the most part, the professors have been trained in Europe and in the United States.

Press, Radio, and Television. Iran has numerous daily and weekly papers or magazines, most of them published in Teheran. Ettelaat, the country's largest publishing company, brings out dailies in Persian, French, and English, an overseas newspaper in Persian, a weekly magazine, and a monthly journal. Almost equal in importance to Ettelaat is Kayhan, with a daily in Persian and English, and an English weekly for the Middle East. Many of the other dailies are personal political sheets or organs of pressure groups. The chief provincial cities also have dailies, but their sales are small.

Newspapers are frequently suspended when the government objects to their editorial policy. A technical suspension of only a few hours has generally been sufficient to bring a newspaper's point of view at least temporarily in line with the government's.

Radio Iran, which was founded in 1938, is government owned and operated. It broadcasts from Teheran not only in Persian, but in Urdu, Kurdish, Arabic, Turkish, English, Russian, and French. There are also radio stations in the other chief cities. In 1963 there were close to a million radio receivers. The television stations are privately owned. Their programs were received on approximately 67,000 sets in 1962.

5. GOVERNMENT

Iran's form of government was established by the constitution of 1906 and its subsequent amendments. The constitution provides for a monarchy, an executive branch composed of a premier and cabinet, and a parliament composed of an upper house, the Senate, and a lower house, the Majlis.

Iran is not a full-fledged parliamentary monarchy. The shah has at times ruled autocratically, forbidding the formation of political parties, or creating parties that would not balk his wishes, and then allowing only these parties to contest an election. Parliament was suspended altogether in 1961 when it threatened to block the shah's

program. However, the constitution has survived severe political crises, and it remains a blueprint for the government of the nation, at least in times of relative tranquility.

Executive. By the terms of the constitution, the shah has command of the armed forces; he has the sole authority to declare war and conclude peace; and he names and dismisses the premier, although his choice must be confirmed by the lower house, the Majlis, to which the premier and cabinet are responsible for executive action. Parliament may be dissolved by the shah.

Legislature. Half of the Senate's 60 members are appointed by the shah, and half are elected indirectly by the people.

The lower and more powerful house, the Majlis, has 200 members, elected every four years. Election was by universal male suffrage until 1963, when women over 18 were given the vote.

Members of the legislature must be Muslims except for four members in the Majlis: the Christians are represented by two members, the Jews and Zoroastrians by one each. To become a law, a bill must be approved by both houses unless it is a bill pertaining to public finance. In that case it needs the approval only of the Majlis.

Political Parties. Under Reza Shah (reigned 1925–1941), all political party activity was proscribed. After his abdication in 1941, the Tudeh party, which was Communist-oriented, was formed. It played an important role in national politics until it was outlawed in 1949 after an attempt on Mohammed Reza Shah's life had been traced to the Communists. Driven underground, the Tudeh continued to work through other political groups set up as fronts for it.

Mohammed Mossadegh's party, the National Front, achieved considerable power during Mossadegh's premiership (1951–1953), then went into decline with his removal from office. The two parties created by the shah in 1957–1958—the Mardom and the Milliyyun—were too artificial to survive. They were not revived in the 1963 election. Instead, a new government-sponsored party, the New Iran party, presented a slate of candidates to the electorate. No other party was allowed to participate in the election, although some candidates without party affiliation ran for office. See also section 6. *History*: Recurrent Economic and Political Crises.

Judiciary. Iran's courts are modeled after those of France. The Supreme Court is the court of final appeal but does not have the power to decide the constitutionality of legislation. Judges try all cases except a few for which juries are called. Judgments are based on the codes enacted under Reza Shah to replace the Islamic religious law.

Local Government. For political and administrative purposes, Iran is divided into 13 *ostans* or provinces—or 14, if the island of Bahrain, to which Iran lays claim, is included. There are also 6 general governorships. Within the *ostans* are subprovinces called *shahristans*, which are made up of *bakhshs*, or counties; within each *bakhsh* are several *dehestans*, or districts, which in turn comprise several villages.

The governors of the *ostans* are appointed by the central government and are responsible to it. In this way the central government has tried to prevent the resurgence of the kind of local autonomy that enabled the USSR to establish the states of Azerbaijan and Kurdistan in 1945 (see section 6. *History*: The Cold War).

6. HISTORY

In prehistoric times there was a great movement of tribes south and west from the steppe country north of the Caspian Sea. These were the Aryans, who settled first in Iran and then dispersed, some south into India, and some west as far as the Zagros Mountains. Assyrian, Hittite, and Egyptian records of about 1500 B.C. disclose Iranian names and portraits. As early as 1700 B.C. the horse, known from remote times to the Aryans, seems to have been introduced to the Greeks and Egyptians by Iranian mercenaries. Numerous Aryan tribes, speaking for the most part some form of ancient Persian, gradually settled most of the Iranian plateau. They also settled what is now southwestern Iran, which was the ancient kingdom of Elam. The Medes, people of another Aryan strain, occupied the high mountainous plateau in northwestern Iran and appear in history about 836 B.C.

The Achaemenids. The first Persian empire was created in the 6th century B.C. by the Achaemenid dynasty. The dynasty took its name from its founder, Achaemenes (Hakhamanish), who in the 7th century B.C. ruled Parsumash, a small kingdom northeast of Elam. Achaemenes and his son Teispes were subdued by the Medes. Nevertheless, in alliance with Assyria, they were able to take over what is now the Iranian province of Fars. One of their successors, Cambyses I (reigned 600–559 B.C.), married the daughter of the Median king Astyages, and their son Cyrus II the Great came to the throne of Fars in 559 B.C.

Cyrus immediately revolted against Media and defeated Astyages in 550 B.C. In 546 he overthrew Croesus of Lydia, and in 539 he took Babylon. The fall of Sardis in 546 B.C. and the ensuing capitulation of the Greek towns brought the Persians to the Mediterranean. Meanwhile, the nomads to the east and the tribespeople of the plateau had been drawn into the rapidly consolidating Persian empire. In 529 B.C., while campaigning against the eastern border nomads, Cyrus was killed.

Cyrus' son Cambyses II (reigned 529–522 B.C.) fulfilled his father's plan to conquer Egypt, the last great power to fall to the Persians. Upon receiving reports that Gaumata the Magian had usurped the throne in Persia, however, Cambyses, en route from Egypt, committed suicide.

Gaumata's uprising was unsuccessful, and Darius I, who belonged to another branch of the Achaemenid family, became king in 522 B.C. Under Darius the empire reached its greatest territorial extent. After subduing revolts in half a dozen provinces, Darius crossed the Bosphorus, successfully engaged the Scythian tribes along the Danube, and pacified Thrace and Macedonia. He then turned to India and penetrated well into the Punjab and Sind. In 499 B.C. the Ionians and the Carians, aided by Athens and Eretria, rebelled. This action precipitated a long series of disastrous campaigns against Greece, the most famous of which ended at Marathon (490 B.C.).

Darius was succeeded in 486 B.C. by his son Xerxes, who continued the Persian wars against the Greeks. But his fleet was cut to pieces by the Athenians at Salamis in 480 B.C., and his magnificent infantry fell before the Greek phalanx at Plataea the following year. The Achaemenid rulers never again attempted any serious campaign of territorial expansion.

The imperial organization begun by Cyrus and



Frederick Ayer III, Photo Researchers

The ruins of the imperial palace at Persepolis recall the greatness of the Persian empire under Darius I and Xerxes.

perfected under Darius I was wisely conceived. The military superiority of the Persians was due largely to their lightly armed bowmen, unsurpassed in courage and skill, and to their distinguished cavalry. Although imperialistic wars were waged, at no time in history have conquered peoples been more honorably and generously dealt with in matters of administration, law, culture, or religion. The Persian leaders worshiped "the great God, Ahuramazda," but there was no attempt to enforce his worship on others.

During the hundred years following the Greek wars the empire slowly disintegrated. Rebellions, intrigue, and assassinations, combined with degeneration of the royal line, brought the glorious Achaemenids to an ignoble end.

Alexander and the Seleucids. Under Darius III (reigned 336–330 B.C.), last of the Achaemenids, the empire was lost to the Macedonian ruler, Alexander the Great. The Persian capital, Persepolis, was burned, Darius was murdered, and Persia became a part of the Macedonian empire. Alexander died in Babylon in 323 B.C., and his empire was divided among his lieutenants. Seleucus I Nicator (assassinated 280 B.C.) acquired by conquest and intrigue the greater portion of Alexander's Asian domains, with Persia at its core. (See **SELEUCIDS**.) Border warfare and internal troubles followed, and gradually the Persian kingdom fell prey to the neighboring Parthians.

Parthian Rule. The Parthians were an Iranian people who had successfully established an independent kingdom to the northeast in what is modern Khurasan. (See **PARTHIA**.) By 138 B.C. they had expanded their rule to cover almost exactly the territory of modern Iran. The Ar-

sacid dynasty of the Parthians claimed descent from the Persian king Artaxerxes II, and they worshiped the god Ahuramazda. But their culture was Philhellenic. (See **ARSACIDS**.) They had a long history of opposition to Rome. Orodes II (reigned 57–37 B.C.) defeated Marcus Licinius Crassus in 53 B.C., and in 36 B.C. Phraates IV (reigned about 38–2 B.C.) overcame Mark Antony. The last Parthian king, Artabanus V (reigned about 213–224 A.D.), won a decisive victory over the Romans in 217 A.D.

Sassanids. About 224 A.D. Ardashir, a ruler of one of the small states within the empire, who claimed descent from the Achaemenid line, revolted against his Parthian overlord and defeated him on the plains of Hormuz. He established the line of Sassanid kings who were to rule Persia for more than 400 years, until the Arab conquest in 641.

The Sassanid period was characterized by a revival of the ancient Achaemenid culture and a corresponding lessening of Greek influence. Ardashir restored the Zoroastrian religion, collected its sacred texts, and reinstated the priestly Magians. He defeated the Roman emperor Alexander Severus in 232 A.D., but he did not push his advantage or retain Mesopotamia in the subsequent peace because his interest had shifted to the east, where he extended his borders. Shapur I (reigned 241–272 A.D.), son of Ardashir, captured the Roman emperor Valerian in 259, but, it was left to Shapur II the Great (reigned 309–379) to secure the western frontiers finally against the Romans.

During the reign of Bahram I (reigned 273–276), successor to Shapur I, the new Manichaean religion gained a considerable following at the

Persian court. But the Magian priests intrigued against the religion's founder, Mani. In 276, Mani was executed, and the Manichaeans were driven from court.

Royal intrigue, religious strife, internal trouble, and border warfare characterized the century after the death of Shapur II in 379 until the accession of Kavadh I (Kobad; reigned 488-498, 501-531). Kavadh restored internal order and crushed the White Huns from inner Mongolia, who had long harassed the eastern outposts of Persia.

In the same century there was a constantly changing official policy toward Christians and Jews. But in 483, under Firuz II (Peroz; reigned 457-484), the Nestorian doctrine was recognized as the legal form of Christianity in the Persian empire.

Khosrau I Anushirvan (reigned 531-579), also known as Chosroes I and as Noshirwan, was the most illustrious of the Sassanid rulers. He was successful against both the Romans and the newly powerful Turks, and he aided the Yemen Arabs in expelling the Abyssinian invaders. Internally, Khosrau completely wiped out the Mazdakites, a communistic sect that had flourished under his father, and he restored Zoroastrianism. He revised the tax system, made great advances in administration, and generally proved himself an enlightened monarch. After his death, dissension and rivalry enfeebled the kingdom.

In the 630's Islam began its sweep over the Middle East and North Africa. In 641 at Nehavend, south of modern Hamadan, the Sassanid ruler Yazdegerd III was routed by the Arab Muslims. Ten years later he was murdered at Merv, and the Sassanid dynasty came to an end.

Caliphal Rule. By 650, with the exception of a few remote and isolated districts in northern Media, the Arabs had reached the Oxus River (modern Amu Darya), and Persia had become a part of the caliphal empire. Arab administration was reasonable, and there was little interference with folk customs or religion as long as order was maintained and taxes were paid. Many Persians became Muslims under economic pressures. In 750 the Umayyad (Omayyad) caliphate was supplanted by the Abbasids, who moved their capital to Baghdad in 762. Thereafter the Persians gradually rose to a position of increasing importance intellectually, socially, and politically in the Islamic empire.

With the gradual disintegration of the Abbasid caliphate, numerous minor dynasties succeeded one another in Persia. Among these, the Samanids (874-999), who had first been governors in Turkestan and Khurasan, gradually built up a strong feudal kingdom, genuinely Persian in culture. Its enlightened rulers revived the Persian language, were patrons of art and learning, and expanded commerce.

The Abbasid caliphate had imported Seljuk Turks and other mercenaries. Eventually, under a merely nominal sovereignty of the caliphs, the Seljuks gradually assumed power and control. (See SELJUKS.) Most famous of these Seljuks was Malik Shah (Jalāl-al-Dīn Malikshāh, reigned 1072-1092), with whom the power of the Seljuks reached its zenith. Illustrious Persian intellectuals flourished in this Seljuk period: Firdausi (940?-1020), creator of the Persian epic, the *Shah Namah*; Avicenna (980-1037), physician and philosopher; 'al-Ghazzālī (1058-1111), philosopher and theologian; and Omar Khayyām (d. about

1123), who was a poet-philosopher, mathematician, and astronomer.

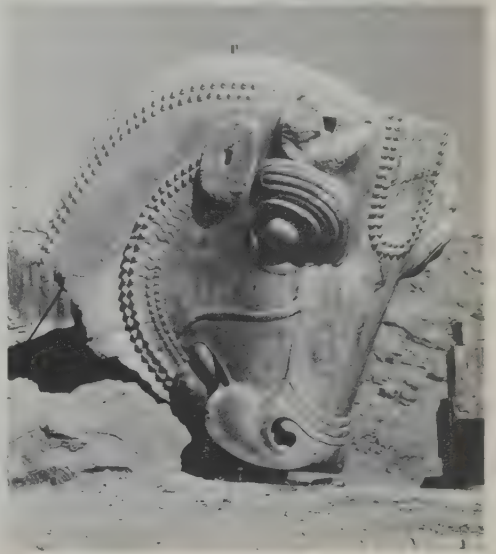
Mongol Rule. In 1220 the invasion of the Mongols began, first under Genghis Khan and then under his grandson Hulagu Khan, who took Baghdad in 1258, bringing the caliphate to an end. Hulagu became the first Il-khan (provincial ruler). He and his successors controlled Persia until the middle of the 15th century. The Mongol Tamerlane (Timur; about 1336-1405) ravaged, pillaged, and destroyed everything before him, but his son Shah Rukh (reigned 1404-1447) repaired much of the devastation and encouraged a revival of art and science.

Safavids. In 1502 a new national dynasty, the Safavids (Safawids; 1502-1736), arose and put an end to foreign domination. Through their ancestor, Safi-al-Din, the Safavids traced their line to the seventh imam and through him to Ali, the son-in-law of Mohammed. They, therefore, made Shi'ite Islam the official religion of Persia. Shah Ismail I (Ismā'il; reigned 1502-1524) defeated the Uzbeks in the northeast, while on the west he reorganized Azerbaijan against the Ottoman Turks, now the strongest enemies of the Persians. Shah Abbas I the Great (reigned 1587-1629), in a series of wars, routed the Ottomans and regained all the territory formerly lost by Persia, including Baghdad. Abbas was not only a great military leader. His fame also rests on his religious tolerance, his genius for organization and administration, and his patronage of architecture and science. He rebuilt Isfahan and made it his capital, established profitable commerce with Europe, and welcomed travelers and ambassadors. During his reign the British and Dutch wrested the Persian Gulf from the Portuguese. But Abbas' jealousy of his sons prevented the training of an heir to carry on his splendid work, and the century following his death in 1629 was a period of slow decline.

Under Abbas II (reigned 1642-1667) there was a brief revival of Persia's glory, but by 1722 Isfahan had fallen to the rebelling Afghans, and

This bull's head once adorned the palace at Persepolis.

Diane Rawson, Photo Researchers





Hossein Sangui

Shah Abbas, the great Safavid ruler, moved the capital to Isfahan in 1598 and embellished it with this ornate mosque.

during the ensuing chaos Russia and Turkey seized large parts of Iran. Nadir Kuli Beg, an Afshar tribesman and brigand, joined by Prince Tahmasp, collected a large force and routed the Afghans, regaining much territory in Khurasan. Successful military raids and campaigns also led to the expulsion of the Russians and the Turks. In 1736, after deposing the last Safavid ruler, Nadir was crowned shah. He then attacked India, sacking Delhi, and conquered Khwarizm (Khiva) and Bukhara. Unfortunately, he had little administrative ability, could not stand success, grew arbitrary and despotic, and appeared at times derailed. He was murdered in 1747.

The Kajar Dynasty and Foreign Influences. The Kajar and Zand tribes contested for the throne, and Karim Khan, a Zand of Fars, was victorious. He retained the designation *vakil* (regent), never assuming the royal title of shah. From 1750 to 1779 he reigned justly and humanely, and has become a legend in Iran. He moved the capital to Shiraz, and enlarged and beautified the city. Agha Mohammed Khan, of the Kajar tribe, who proved to be a cruel ruler, became the first of the Kajar kings, who were to rule until 1925.

Beginning with the reign of Fath Ali Shah (reigned 1797–1834), Persia rapidly became drawn into European power politics. Napoleon, with an eye to attacking the British in India, concluded a treaty with Persia in 1807 and sent a military mission to Persia to train an army. Two months later, however, Napoleon made a treaty with the Russians at Tilsit, and the shah could hope for no help from France in regaining Georgia from Russia. In 1814, Persia concluded a treaty with Britain whereby in effect Persia became a buffer state between India and Russia. Military campaigns in Georgia ended in complete disaster for the Persians, and in 1828 the Russians forced on them the Treaty of Turkmanchai, by which Persia lost most of her territory in the Caucasus to Russia. Russia also demanded extra-territorial rights within Persia and an indemnity. This treaty set the example for the conduct of other European nations in their later negotiations with Persia.

In 1834, Britain and Russia guaranteed Persian independence. Mohammed Shah (reigned 1834–1848) attempted to regain prestige by the conquest of Afghanistan, but Britain, fearful of Russia's dominance of Persia in Afghanistan, succeeded in bringing about his withdrawal.

Reign of Nasr-al-Din. Mohammed Shah's death left his son Nasr-al-Din heir to a government on the edge of bankruptcy and revolution. Nasr-al-Din reigned from 1848 to 1896. During this long period Persia became more and more involved with foreign interests, to which it was forced to make more and more concessions. To protect their position in India, the British wanted to build a strong Afghanistan as a buffer to the advancing imperial aims of Russia. By the brief Anglo-Persian war of 1856, the British compelled Persia to evacuate Afghanistan completely in 1857. By 1864 the British had constructed telegraph lines to India through Persia, and in 1889 they obtained a favorable concession in the founding of the Imperial Bank of Persia. The British also opened the Karun River to navigation and commerce.

Meanwhile various military missions succeeded one another in Persia—British, French, and Austrian—but the Persian Cossack brigade, Russian-trained and officered, was the only efficient and reliable unit.

Nasr-al-Din had begun his reign auspiciously by appointing Mirza Taqi Khan of Tabriz as his vizier. Taqi Khan was brilliant, industrious, and devoted. The much-needed reforms he instituted produced a swarm of enemies who brought about his execution—a tragic disaster for Persia. The shah was not opposed to reform, and his three visits to Europe had awakened his interest in enlightened rule, but he was unqualified for effecting modernization and was hampered by jealous foreign interests that constantly interfered with or blocked many of his attempts. He did, however, establish the beginnings of a modern college in Teheran and sent many young Iranians to France for higher education. The ruthless persecution of the Bábist sect (later Bahá'í), a religious group founded in Shiraz by Mirza Ali Mohammed, the Báb, was a blot on his record. See BĀBISM.

The End of the Kajar Dynasty. Under Muza'far-al-Din (reigned 1896–1907), the British and Russians again played off one another to Persia's loss, with Russian influence on the increase. A British loan in 1892 was countered by a Russian one in 1900, guaranteed by customs receipts, except those from Persian Gulf ports. The terms of the Russian loan stipulated the payment of the British loan, and prohibited the obtaining of any further foreign loans within 10 years. But the Russian loan was dissipated by the shah's personal extravagances, and Mohammed Ali Shah, succeeding in 1907, took over a bankrupt government.

During the reign of Nasr-al-Din, a movement had begun to limit the shah's power. During Muza'far-al-Din's 10-year reign, there was a marked deterioration in respect for the throne. By 1905 there was a definite movement in favor of a constitution, and a dramatic series of events brought about the formation of a National Assembly which Muza'far-al-Din opened just before his death. The next shah, Mohammed Ali, supported by Russian influence, attempted three times to overthrow the constitution, but he failed and was forced to abdicate in 1909 in favor of the boy king, Ahmed Shah, the last Kajar ruler.

Meanwhile, Russia was ready to conclude an agreement in Asia with Britain to prevent the spread of German influence. By the Anglo-Russian Convention of 1907, Persia was to be divided into two spheres of economic influence, the Russians to control the entire north as far south as Isfahan and Yezd, and the British to take over

the southeast, with a neutral zone separating them. The convention was soon rendered strategically obsolete from Britain's point of view by the discovery of oil in Persia. In 1901 a concession had been granted to William Knox D'Arcy, a British subject, establishing a monopoly in the search for and exploitation of oil in Persia, with the exception of the five northern provinces. In 1909 the Anglo-Persian Oil Company was formed, based on this monopoly. In 1914, following the conversion of the Royal Navy from coal to oil for fuel, the British government became the majority stockholder in this company.

In May 1911, William Morgan Shuster, a United States citizen, was brought to Persia as financial adviser, to build a fiscal foundation for constitutional independence. As treasurer-general, Shuster won the approval of the liberal forces in the country by his skill in reorganizing the country's finances. Alarmed by Shuster's success, which bolstered liberal forces, Russia demanded his dismissal and threatened to occupy Teheran. Russian bribery and intrigue, together with a show of military force, brought about the illegal dissolution of the National Assembly, or Majlis, in December 1911 and the termination of Shuster's contract. Belgians were then brought in as customs administrators, but no real general improvement was possible.

Russian influence continued to increase until World War I when Persia, unable to defend her declared neutrality, became a cockpit of intrigue and fighting between the Allies and the Central Powers. At the Paris Peace Conference in 1919, Persia submitted claims for the return of her territory annexed much earlier by Russia and Turkey, cancellation of special privileges accorded to certain foreigners, and reparations for damages caused by the war. She was not allowed to plead her case. Subsequently Persian pride was appeased by an invitation to become a charter member of the League of Nations.

Under an Anglo-Persian agreement in 1919, Britain guaranteed the independence and integrity of Persia, agreed to supply advisers to reconstruct the administration, and also agreed to reorganize, staff, and equip the Persian army. Persia was to receive a loan, guaranteed by customs receipts. Anglo-Persian trade was to be extended through improvement of communications and the building of railways. Public opinion, however, was aroused sufficiently to prevent ratification of this agreement with Britain.

In 1920 the Soviet Union invaded Gilan, the coastal province on the west of the Caspian, and set up a Bolshevik republic. In February 1921, Sayyid Zia-al-Din, a journalist, assumed power in Teheran and called for support of the Persian Cossack brigades. Reza Khan, head of a Persian Cossack regiment, marched on Teheran, overthrew the shah's government, and became minister of war. Four days after the coup d'état, on February 26, a treaty with the Soviet government was signed: the Persian debt was canceled and the Imperial Russian Bank in Persia was turned over to the Persian government; the Julfa-Tabriz Railway was ceded to Persia; all occupied territory was evacuated; and all commercial concessions, except the Caspian fisheries, were annulled.

Zia-al-Din, after 100 days of premiership, fled the country, ousted by Reza Khan, who succeeded in effecting the appointment of Qavam as-Saltaneh as prime minister. Reza Khan immediately set about financing and building up an effi-

cient army which he used to subjugate and disarm the contending tribes and to restore public order. In 1922 a strong financial mission headed by Arthur Chester Millspaugh was brought from the United States to reform Persian finances. In October 1923, Ahmed Shah left for Europe, never to return. Reza Khan appointed himself prime minister and convened the Majlis, which granted him military authority amounting to dictatorship. In 1925 the Majlis elected him *shahinshah* (king of kings). As Reza Shah, he assumed the ancient Persian name of Pahlavi for his dynasty.

Reza Shah. Among Reza Shah's first acts as ruler was an aggressive attack on the Muslim ecclesiastics, who had long enjoyed great precedence and power as administrators of religious law. Under Islamic law, many temporal matters were within ecclesiastical jurisdiction. Reza Shah confiscated shrine lands and incomes, turning them over to the government for the support of secular scholars. He did not attack the Muslim faith, but he suppressed the activities of the dervishes and forbade the annual passion plays which for centuries had inflamed religious fanaticism with their violent pageantry. He sent abroad annually 100 students, and from these he later recruited many of his higher officers and administrators. His most startling social reform was the enforced emancipation of women, which began with the discarding of the veil by students and teachers and the gradual appearance of women at official functions. Within two years the veil had practically disappeared in Persia. By 1935 marriage and divorce laws had been reformed; polygamy, although religiously still legal, was discouraged. Schools for girls multiplied and improved, and women began to enter the professional fields—teaching, nursing, medicine, and even law. See section 2. *The People: Marriage and the Status of Women.*

Reza Shah's most basic change was to reform the law along the lines of the Napoleonic Code. The capitulations (special privileges granted to the citizens of certain foreign nations) were abolished in 1928, and Persia regained her independence in matters of customs and tariffs. After exactly a century, Persia was once more in full control of her territory and borders.

In 1932 the government renegotiated the Anglo-Persian oil agreement. Twenty years later, controversy raged over this pact and its result: whether Reza Shah was in reality a free agent in the final decision and whether on balance the new agreement was or was not more favorable to Iran. Certainly at the time, Iranians regarded the result as a national victory.

Under the vigorous and aggressive leadership of Reza Shah, law and order were maintained, communications vastly improved, modernization in all departments of government encouraged, and national self-respect enhanced. His greatest weaknesses were his passion to establish a dynasty in the Oriental pattern and his personal greed for land, wealth, and power, which inevitably resulted in much injustice to individuals.

World War II. During World War II it was impossible for Iran to remain wholly neutral as the Germans occupied the western USSR and approached Iran's northern borders. The British-Russian position was serious. The oilfields had to be protected and a road opened so that supplies could reach the USSR via the Persian Gulf. On Aug. 25, 1941, following unsatisfactory answers to Allied protests to Iran, British and Russian

forces moved to occupy the south and north, respectively. On September 16, Reza Shah abdicated under pressure, and his son Mohammed Reza Pahlavi succeeded him. On Jan. 29, 1942, the prime minister, Mohammed Ali Foroughi, concluded a treaty of alliance with Britain and the Soviet Union, whereby Iran's territorial sovereignty and integrity and her political independence were assured, with the promise that all alien troops would be evacuated from Iran within six months after the cessation of hostilities or the signing of the peace. On Sept. 9, 1943, Iran declared war on Germany.

Allied occupation, control of imports and communications, and extensive spending, together with a poor harvest, brought cruel inflation and near famine. In recognition of the assistance given the Allied cause, Britain, the USSR, and the United States, meeting in Teheran in conference in December 1943, renewed the pledge of the Tripartite Treaty of Alliance and promised to furnish Iran economic assistance both during and following the war. Meanwhile, an American task force had taken over supply lines from the British and moved more than 5 million tons of material to the Russians in the northern zone, to help fend off the German drive toward the east.

By the autumn of 1944, the major battle lines had moved west, and the Allied military effort in Iran had decreased. When American and British oil companies opened negotiations with the Iranian government for oil concessions in southeastern Iran, the USSR attempted to secure a comprehensive agreement with Iran for the exploitation of all mineral resources (including ore) in the five northern provinces, and for the economic development of that whole area. This was the first skirmish of what came to be the cold war between Russia and the West.

Iran and The Cold War. The Iranian government, supported by the Majlis, responded to the Soviet proposal by forbidding Iranians to enter into negotiations with any foreign company or government for an oil concession. Britain and the United States recognized Iran's right to place this restriction on its citizens, but the USSR did not. In the autumn of 1945 the USSR created the autonomous republics of Azerbaijan and Kurdistan in northwestern Iran, thereby attempting to pressure Iran to accept an oil agreement favorable to Russia. Only the marshaling of world opinion through the leadership of the United States in the United Nations, and the initialing by Premier Ahmad Qavam of a treaty for joint Soviet-Iranian development of the northern provinces prevented the Soviet occupation of Iran in March 1946.

In the autumn of 1946, by a combination of internal and external pressures, the shah and the premier felt strong enough to challenge the Azerbaijan and Kurdistan republics, which vanished almost overnight. The United States ambassador declared that Iran as a sovereign state should decide the oil question on its economic merits without being subjected to any political duress. Supported by this declaration, the Majlis in 1947 rejected Qavam's 1946 Soviet-Iranian agreement by a vote of 102 to 2. The independence of Iran had once more been defended.

Nationalization of the Petroleum Industry. Upon its rejection of the Soviet oil agreement, Iran turned its attention to its seven-year development plan, which began with a survey by the United States engineering firm of Morrison-

Knudsen and which was finally drafted on the basis of a comprehensive study and report by Overseas Consultants, Inc., another United States company. This group was also retained to help carry out the plan, which was to be financed initially by royalties from the rapidly expanding petroleum output of the Anglo-Iranian Oil Company. Before this program could be launched, however, a long-standing dispute with the Anglo-Iranian Oil Company became a dominant national issue.

Attached to the Majlis' 1947 legislation rejecting the Russian oil agreement was a directive to the government to do all it could to bring the Anglo-Iranian oil concession as rapidly as possible into line with the newly declared national policy of the development of Iranian resources by Iranians. Negotiations with the Anglo-Iranian Oil Company finally produced the Gass-Golshayan supplementary agreement, by the terms of which more privileges and royalties were to be granted to the Iranian government. These were deemed quite inadequate by the increasingly influential National Front group of Majlis deputies led by Mohammed Mossadegh. This group increased its influence and power in 1950, and resisted all efforts to secure passage of the Gass-Golshayan agreement. The National Front countered the government's plan by demanding the nationalization of the oil industry.

The climax came when a religious fanatic assassinated Prime Minister Ali Razmara on March 7, 1951. Shortly thereafter the Majlis passed a law nationalizing the petroleum industry. Mossadegh was named premier by the Majlis and formed a government dedicated to the nationalization of the Anglo-Iranian Oil Company (renamed the National Iranian Oil Company, or NIOC, after nationalization), the elimination of British influence from Iranian economic and political life, and the institution of various reforms.

By October 1951, all British technicians had been expelled, and the oil industry had been taken over by Iranians. But only 10 percent of the

Shah Reza Pahlavi has ruled Iran with a firm hand since the overthrow of Premier Mossadegh's government in 1953.

Pictorial Parade



industry remained in operation because Iran was unable to produce and to market the product. In January 1952, British consulates in Iran were closed, and the next September, after Mossadegh won a spectacular political tussle with the shah, diplomatic relations with Britain were severed.

Meanwhile, the United States, aiding Iran just enough to prevent the collapse of its deteriorating economy, first played honest broker between the two disputants, and then joined Britain in direct negotiation. After Iran rejected a final Anglo-American offer in March 1953, the United States made it clear that no further aid would be furnished. A struggle between Mossadegh's government and the shah threatened the throne. But a sudden political change of fortune gave the shah the upper hand and he replaced Mossadegh with Gen. Fazlollah Zahedi as premier on August 18.

Within a year, Mossadegh and many of his adherents were tried, convicted, and jailed. Martial law was proclaimed, and controlled elections were held. Under these conditions, a new oil agreement was negotiated with a consortium originally consisting of eight companies—one British (which retained 40 percent of the stock), five American, one Dutch, and one French. The consortium subsequently was expanded to 17. By the terms of the agreement, profits made within Iran were to be shared equally by Iran and the foreign consortium.

Recurrent Economic and Political Crises. General Zahedi was succeeded as premier by Hussein Ala in April 1955. For the next two years attention centered on reviving and implementing the seven-year development plan (Iranian Plan Organization). The first plan had been brought to a standstill by the drop in petroleum exports after the industry's nationalization. With the reactivation of the industry, economic capital development could be resumed. The second seven-year plan was inaugurated in 1956. Oil revenue was used to finance it, and additional grants to keep it going were obtained from outside the country, particularly from the United States.

In foreign relations, Iran abandoned any pretense of neutrality. She aligned herself with the West by joining the Central Treaty Organization (CENTO), then known as the Baghdad Pact) on Nov. 3, 1955, and summarily rejected all Soviet protests against this action. Simultaneously, the government took measures to curb the outlawed but still active Communist-led Tudeh party.

In April 1957, Manuchehr Eqlal became premier and abolished martial law. In office until August 1960, Eqlal admitted he was only the servant of the shah, who actually ruled. So it continued during the premiership of Sharif-Emami, who remained in office until May 1961.

In 1957-1958 the shah created two political parties—the Milliyyun (Nationalist) party, led by Premier Eqlal, and the Mardom (People's) party, directed by Asadullah Alam. The Mardom party was to be his majesty's "loyal opposition." Many scoffed at this artifice, especially the suppressed real opposition. Elections had been postponed by doubling the Majlis' term to four years, but in August 1960 they were due again. The reorganized National Front and vigorous independents like Ali Amini and Muzaaffar Baghai campaigned against the "regulars," and the hustings got so hot and governmental "rigging" so blatant that the shah felt compelled to cancel the elections and proclaim new ones for early

1961. Amini withdrew, and the National Front was forced to do the same. Yet the 20th Majlis proved unstable and difficult. When public feeling got dangerously tense during a teachers' strike for higher salaries, the shah tried a new tactic. He partially retired from rule, appointed Amini premier, and then dissolved the Majlis.

Premier Amini's first task was to prevent further inflation and to stabilize the economy so that foreign credit could be secured again. But a deep economic recession followed the attempt to achieve stabilization. A budgetary crisis developed and, in July 1962, Amini resigned.

The shah appointed Asadullah Alam premier and himself returned to a more active role in the government. The third plan was put into operation in September 1962. The minister of agriculture, Hasan Arsanjani, continued and greatly accelerated the land distribution program, which had begun in 1950. (See section 3. *Economy: Land Reform*.) In 1963 the shah widened this program to include profit sharing for the city laborers, a massive attack on illiteracy, and new civil rights for women. He also dismissed the now too popular agriculture minister, Arsanjani.

In the spring of 1963, conservative reaction to the intended reforms precipitated violence. The riots, successfully quelled, were largely spontaneous though partly directed by religious leaders. The government claimed that the dissidents had received financial assistance from abroad, presumably from the United Arab Republic.

By midsummer 1963 the shah felt sufficiently confident of public security and his political position to announce new Majlis elections. Since the opposition National Front was not allowed to enter its candidates, the government's candidates, most of whom were approved by the shah and sympathetic to his reforms, won easily. For the first time the urban and reform elements were better represented than the landowners.

In March 1964, Alam was replaced as premier by Hassan Ali Mansur, founder of the court-endorsed New Iran party, which had won the 1963 election. The shah's reform programs were continued by Mansur, and after Mansur's assassination in January 1965, by his successor, Amir Abbas Hoveida.

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IRAN, Languages of. There are two categories under which Iranian languages may be considered: (1) the languages of Iran related to the Indo-Hittite or Indo-European languages; (2) the languages of Iran that are non-Indo-European, such as Semitic or primitive Caucasian.

Indo-European Languages.—There is a widely accepted theory that the Indo-Hittite family of languages originally were fairly closely unified in the 2000's B.C. The home of these languages has not been clearly defined, but most authorities indicate the plausibility of regions lying west of the Caspian Sea. In the main branches, such as Indic, Iranian, Hellenic, Italic, Germanic, and Slavic, there are striking similarities in certain words—but there is no common word for *sea*. Late in the 2000's B.C. the unity of the Aryan people, speaking these related languages, seems to have broken up. As these peoples migrated, separate evolutionary trends took place, and borrowing from the peoples whom they conquered contributed to the changes. By about 2000 B.C. there were two rather clearly defined groups: the western Indo-Germanic group and the eastern Indo-Iranian group. The key word used in distinguishing them is the word for "hundred": *centum* in Latin and *satem* in Sanskrit. The *satem* group includes the Slavic, Iranian, and Sanskrit languages.

The migrations which carried the Indo-Iranian languages to Iran and India seem to fit best into the period between 2000 and 1500 B.C. As they wandered around seeking living space, the Aryan tribes drove the primitive inhabitants into hilly or difficult regions and appropriated the better lands for themselves. It was probably in this period that the earliest Indo-European religious hymns were composed. These poems were not reduced to writing until later ages. Passed down by oral tradition for centuries before being recorded, they thus represent the oldest Iranian linguistic tradition. Some of these came to form part of the collection called the Rig Veda (*Rgveda*). Dating back to the middle of the 2d millennium B.C., the Rig Veda represents a compilation of centuries of ritualistic hymns. It was not reduced to written form until the 3d century B.C. (See also BRAHMANISM; INDIA—9. *Languages* and 11. *Literature*; RIG VEDA.)

About the 12th century B.C. several wandering Aryan-speaking tribes invaded the Plateau of Iran. Records of a campaign of the Assyrian king Shalmaneser III show that he met the spearhead of these invaders, called the Medes (Mad or Mat), about 836 B.C. (see MEDIA). They later settled in northwestern Iran. Whether they reduced their language to writing is yet unknown. Rock-cut tombs assigned to the period and supposed to belong to Median aristocracy are without inscriptions. The only surviving terms are names of persons and objects imbedded in documents of a later age. Following them came the Pars (Persians), who had settled in southwestern Iran by the middle of the 7th century B.C. A smaller group, the Khuz, penetrated the plains near the Persian Gulf. The Carmanians, the Sakas (Saca or Shaka), and others settled in central or eastern Iran. These all called themselves Aryans and spoke related tongues. They eventually gave their names to such locations as Hamadan (Hang Mat-an), Fars, Khuzistan, Kerman, and Seistan. Still others occupied eastern Afghanistan, where they established an Iranian dialect of which Pashto (Pushtu) is the modern descendent. It

was made the official language of that country in 1936.

It is worthy of note that the Achaemenid kings, who boasted that they were Aryans, adopted or borrowed from the Medes the title "King of Kings of the Aryan Tribes." When Cyrus the Great (r. 559–529 B.C.) expanded his empire, he referred to it as Iran and An-Iran, the latter referring to the non-Iranian territories. Each tribe had its own king, and the distinguishing factor marking a non-Iranian was his language and tribal affiliation, though these groups were now considered as parts of an Iranian Empire. The name Iran therefore goes back to the 6th century B.C. as the official name of the country. Within this political federation hegemony shifted from tribe to tribe, first from the Mad of the northwest to the Pars of the southwest. After the Hellenic period, the Parthians (Parth or Parti) of the northeast revived Iranian dynastic rule (c. 250 B.C.–226 A.D.), following which it reverted to the Pars again (Sassanid dynasty 226–641 A.D.).

The Old Persian seems to have an eastern (Bactrian) and a western form, perhaps influenced by Median elements. The earliest records of the Old Persian are found in the famous inscription of Darius I (r. 522–486 B.C.) at Behistun (q.v.). It consisted of 36 syllabic signs and 7 other signs. The teachings of Zoroaster, genuine or attributed to him, were collected later in a combination known as the Avesta, or Zend-Avesta. Additional inscriptions are known near Hamadan (ancient Ecbatana), and in 1936 a wealth of material was discovered in the royal Achaemenid palaces at Persepolis and on the Ka'abah, or shrine, of Zoroaster at Naksh-e-Rustam. The language is closely related to Sanskrit.

Alexander the Great allowed most of this literature to be destroyed, and Greek was substituted as the official language during the four centuries of Parthian rule. These kings considered themselves philhellenes and suppressed official expression in Iranian terms. But with the outburst of Iranian nationalism fostered by the Sassanid dynasty, the Old Persian, which had always been the language of the people, reappeared in the form of Pahlavi (Pehlevi), or Middle Persian. One of the main documents is the great inscription found at Paikuli (dated about 293 A.D.). There were dialects such as the Middle Parthian in the north, Middle Sogdian in the northeast (which had a revival in the 9th century A.D.), and Middle Sacian in the east.

The Arab conquest of 641 A.D. imposed Arabic upon Iran, except where heretical groups persisted in preservation of the old literature in secret. A colony of Persians who refused to accept Islam migrated to India, taking their religious books with them, and thus preserved a mass of literature which probably would have been lost in Iran. These Parsis still utilize the Avestic or Pahlavi for their ritualistic devotions.

The great counterreaction to Arabic swept in during the reign of the Samanids (874–999 A.D.), one of the native Persian dynasties. At the court of Mahmud of Ghazni (r. 999–1030), poets vied in a renaissance of Persian. The most famous of Persian patriots, Firdausi (c. 935–1020),¹ composed the *Shah Nameh*, q.v. (*Book of the Kings*) in lyric Persian poetry, eliminating most Arabic words and thereby establishing the style for Modern Persian (c. 1010). It differed consider-

¹Some authorities also give 932 and 934 as possible birth dates, and 1025 as a possible death date.

ably from its parent speech, becoming greatly simplified. Final consonants were weakened; the noun retained only two cases, the nominative and the objective; vestiges of the definite article were kept; and the verb showed similar simplification, there being only two main parts, rather closely related. Tense relations were indicated by the addition of prefixes and auxiliary verbs (*to be, to have*). Person was indicated by suffixes.

The Seljuk Turks invaded Iran in 1037 and soon borrowed the Persian culture. The use of Modern Persian increased in popularity. Travelogues, such as *Safar Nameh* by Nāṣir-i-Khusraw (Khosrau; d. about 1074), the *Siyasat Nameh*, a treatise on government by the celebrated Nizām-al-Mulk (1018–1092), and various studies in geography made their appearance. This was also the age of Omar Khayyām (d. 1123) and the *Rubāiyāt*. An excellent translation of *Tārīkh al-Rusul w-al-Mulūk*, commonly known as the *Annals*, written by al-Ṭabari (838–923), was made in pure Persian.

During the Crusades, Fars took the lead in cultural prominence, developing such outstanding poets as Sa'di (1184?–1291) and Ḥāfiz (d. 1389). Coupled with Jalāl-al-Dīn al-Rūmi (1207–1273), the mystic, and Jāmi (1414–1492), these four and a number of lesser lights raised Persian to a pinnacle whence its influence flowed eastward to the Mogul court in India, Persian becoming the court language of Agra, while westward it was considered a sign of culture in Constantinople (now Istanbul) to be able to read or to write Persian.

The religious influence of Islam, with its preference for Arabic as a divinely revealed eternal tongue, weighed heavily on Persian literature. Arabic was a sign of erudition, wherefore writers too frequently rivaled each other in their effort to use Arabic words, phrases, and idioms. During the 18th and early 19th centuries, Persian became little more than a vehicle for connecting Arabic words. Many compound words appeared—half-Arabic, half-Persian.

After 1852, with the appearance of Naṣr-al-Dīn (r. 1848–1896) of the Kajar dynasty (Turkish), official efforts to simplify Persian appeared. This tendency was accelerated by groups of students who went abroad, especially by a group in Berlin who, after the turn of the 20th century, published *Iranshahr* and other literary magazines of excellent taste. The rise of Iranian nationalism under the vigorous rule of Riza Shah Pahlavi (r. 1925–1941) witnessed a continuing revolt against Arabic culture and an effort to restore Persian to its former glory. An academy was established in Teheran. Its function was to purify Persian from foreign words. Long lists of Persian and Arabic words were issued monthly, the former to be introduced through schools, the press, and the platform, while the latter were strictly prohibited. Unfortunately, the bulk of literature appearing consisted of translations from French and English originals, much of it worthless trash. Yet much original material also saw the light. This trend came to a sudden end on Aug. 25, 1941, when foreign troops invaded Iran; Riza Shah Pahlavi abdicated September 16 and fled, and the academy practically ceased to function.

Aside from the official Persian imposed upon the country by the Teheran government's effort at cultural unification, many Iranian branch languages are alive in peripheral regions. While they retain some archaic forms, in other ways they

have diverged further from the old classic language. Around the southern shores of the Caspian, in the provinces of Gilan and Mazandaran, the common speech is called Gilaki or Talishi. It is reminiscent of the Persian of Sa'di and is spoken by nearly a half million people, but has no significant literature. In eastern Afghanistan, Pashto is being revived as the official language, although Modern Persian has been the vehicle of communication for centuries. In western Iran several languages are discernible. Kurdish is the language of some 3,500,000 people stretching into Iraq, Syria, and Turkey. From the known traces of the ancient Median language, it is suggested that it has been one of the elements in the formation of Kurdish. However, so varied are the Kurdish dialects that some are incomprehensible to Kurds of a distant region. The Mukri dialect is conceded to be the purest. It has developed only a small literature. Probably most voluminous in literary production has been the Sorani dialect of Kermanji (Kurdish), which centers around Sulaimaniya in Iraq. On the periphery, Kurdish has mixed with foreign tongues to form the Zaza in eastern Anatolia (around Siirt) and the Laki near Kermanshah in the South. A courageous effort to use the Latin script has been made by Kurdish leaders in exile in Damascus. The three centers of agitation for development of Kurdish as a means of education are at Mehabad (Saujbulagh) in Iran, Sulaimaniya in Iraq, and Damascus in Syria. In Turkey the central government is making extreme efforts to eradicate Kurdish culture and to impose the Turkish. This movement is complicated by strong political overtones. In Iran also printing of Kurdish literature is prohibited. During the brief Kurdish Republic of Mehabad (1946), there was a flurry of Kurdish literary production encouraged by the donation of a printing press by the Soviet Union, but inasmuch as this material was politically separatist, it was condemned to destruction upon collapse of the regime. Farther south are found the Lurs, whose speech betrays early Iranian origins. West of Isfahan are the Bakhtiari tribesmen, whose speech is reminiscent of old Persian. In the southeast are Baluchi, remnants of age-old Iranian settlers, whose dialect differs from their neighbors. Isolated in the northwest Caucasus are a few thousand Ossetians, descendants of the Alans, whose mountain home has protected them from loss of an Iranian speech, though separated in time and space. Nestled in high valleys, small pockets of vestigial Iranian communities are to be found whose speech sounds medieval. In 1938 Miss Ann K. Lambton published *Three Persian Dialects*, which illustrates this phenomenon. These archaic local dialects have no literature. Tat, a Persian-type dialect, is spoken in the Tarum Valley east of Zenjan, and in isolated mountain villages, such as Harzand north of Tabriz. (See also ASIA—6. Languages [Southwest Asia].)

Armenian remains a puzzle. Recognized as a separate branch of the Indo-European family, it has undergone many changes and includes many Persian loan words borrowed during the Parthian period (250 B.C.–226 A.D.). The lost Armenian sources fused with Caucasian, Old Vannic, and possibly other groups; then, because of the intimate political association in Pers-Armenia during the Parthian and Sassanid periods (c. 250 B.C.–641 A.D.), Armenian took on an added load of Middle Persian terms. It first was reduced to

writing in the 5th century A.D. in the monumental translation of the Bible into the classic (*gerapar*) form. (See ARMENIAN LANGUAGE AND LITERATURE.) Islands of Armenian communities, each using a distinctive dialect, have survived in parts of Iran, but their cultural association has been tied closely to the Armenian community living around the headwaters of the Aras River, where a voluminous literature has been produced. In peripheral regions Armenians have borrowed Turkish or Persian loan words heavily from their neighbors and, in some cases, lost their mother tongue completely. The educated Armenians speak Eastern or "Russian" Armenian, which differs from "Turkish" or Anatolian Armenian.

Non-Iranian Languages.—Iran has been the home of many non-Iranian languages. The earliest recorded language of Iran was Elamite (3d millennium B.C.) with its center at Susa. While records have been scant, one column of the famous Behistun inscription is in Elamite. In 1936 fresh finds of tablets were made at Persepolis. As far as can be determined, Elamite was not related to the Indo-European family.

About the 18th century B.C., there appeared the Kassite Empire. The Kassites, or Cossaeans, left little but a series of names, but these indicate no Indo-European associations.

Following the 9th century B.C., Assyrian kings made repeated raids into western Iran. After the disappearance of the Assyrian Empire, the cultural heritage lived on and, during Christian times, the Eastern Aramaic dialect, called Syriac, became the language of the Nestorian Church, which had several thousand members in northwestern Iran. Numerous religious documents in this branch of the Semitic languages have been preserved. Known in the 8th and 9th centuries as the Peshitta, it is the ritualistic language of the Nestorian Church. Because of World War I, this religious community was scattered and its literature has almost disappeared in Iran. (See also SYRIAC LANGUAGE AND LITERATURE.)

Another of the dead languages used in Iran as an official language was the Babylonian, employed by the Achaemenid kings (550-330 B.C.). It was the third form in the trilingual inscription at Behistun and is found elsewhere in ancient rock carvings. Aramaic (q.v.) was probably the most commonly used language throughout the empire.

In 641 A.D., the Arabs invaded Iran and established Arabic as the written tongue. Iranians did not speak Arabic except in southwest Iran, where tribesmen related to the Arabs of Iraq carried their speech with them. (Vigorous efforts were made by Riza Shah Pahlavi in the 20th century to force a substitution of Persian, but the program was only slightly successful.) (See also ARABIC LANGUAGE.)

The records of the 7th century indicate that Turkish elements were intruding into northeast Iran at that time. Under the middle Abbasid caliphs, Turks were hired as mercenaries to fight the many battles of the caliphs, resulting in the establishment of numerous Turkish-speaking garrisons throughout the Eastern Caliphate. By 1050 the trickle of Turkish migrants became a flood. They settled throughout the north of Iran, and in Anatolia, setting up Seljuk military fiefs, which established Turkish all the way from the Gobi Desert to the Aegean Sea. The Turkic dialects in Iran, of which the Azerbaijani dialect is best known, remain today as the mother tongue

of most of the people of Khurasan and Azerbaijan as well as of the Qashqai tribes in the south. It has had little literary influence, however, though the dominant ruling dynasties of Iran for 700 years have been Turkish-speaking families from the north. This Turkic dialect in Khurasan resembles the speech of the Turkoman tribes of southern Russia and northern Afghanistan. In Azerbaijan, it is more akin to the Turkish of Erzurum. It has borrowed more Persian and considerably less Arabic than the Turkish of Anatolia (Osmanli Turkish). In recent years, the Turkish Republic has sought to revive Turkish words to replace Arabic or Persian loan words and in the small literature of Azeri (Azari) poetry was discovered a rich source of archaic but untainted Turkish. An agglutinized language, it boasts one of the most regular grammars of any language in the world. There is but one principal part to the verb, and syllables representing the tenses, voices, and persons are added to the root in regular order. It is therefore rich in flexibility, expressibility, and clarity. The Soviet Union has adapted it to use with a Russian alphabet, although the Arabic script is also used. In 1944, with the appearance of a Soviet-inspired autonomous revolution in Azerbaijan, this "Azeri" Turki was made the official language of the province, but the permanence of such a practice will depend upon political developments in the future.

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IRANIAN LITERATURE. See PERSIAN LITERATURE.

IRAQ, ê-râk' or î-râk' (Arab. AL-'IRÂQ), an Arab republic in western Asia. One of the modern Arab states which arose after World War I from the ruins of the Ottoman Empire, Iraq was formed of three Ottoman vilayets (provinces): Mosul (al-Mawşil) in the north, Baghdad (Baghdād) in the center, and Basra (al-Basrah) in the south. Iraq is bounded on the north by the mountains of eastern Turkey; on the east by the Zagros Mountains, through which runs the Iranian frontier; on the south by the head of the Persian Gulf and Kuwait; on the southwest by Saudi Arabia; on the west by Jordan; and on the north-west by Syria.

Iraq has an area of 171,599 square miles and a population (1957 census) of 6,538,109. The capital, Baghdad, according to the 1957 census, had a population of 852,324; other large cities are Mosul (261,171), Basra (327,593), 'Amara (225,778), and Kirkuk (221,931).

The flag of Iraq consists of three vertical stripes of equal width; the dexter black, the center white, and the sinister green. Centered in the white stripe is a red eight-pointed star. Within the star is a yellow circle bordered in white. The basic monetary unit is the dinar,

IRAQ—1. Political Divisions, Population, and Chief Cities—4. Economic Development

valued (1958) at \$2.80 in United States currency. Detailed discussion of Iraq is given under the following headings:

1. Political Divisions, Population, and Chief Cities
2. The People
3. The Land
4. Economic Development
5. Government
6. Education
7. History
8. Bibliography

1. POLITICAL DIVISIONS, POPULATION, AND CHIEF CITIES

For administrative purposes, Iraq is divided into 14 *liwas* (provinces) and 3 desert administrative districts, the areas, 1957 populations, and capitals of which are given in the following table. See also separate articles on the chief cities.

Divisions	Area square miles	Population	Capital
<i>Liwas</i>			
'Amara	7,096	329,647	'Amara
Baghdad	4,924	1,306,604	Baghdad
Basra	4,747	502,884	Basra
Diwaniya	5,825	507,548	Diwaniya
Diyala	6,224	329,813	Ba'quba
Dulaim	15,751	234,262	Ramadi
Erbil (Arbil)	6,943	272,526	Erbil
Hilla	2,101	353,614	Hilla
Karbala	2,340	217,015	Karbala
Kirkuk	7,859	388,912	Kirkuk
Kut	6,392	290,070	Kut al-Imara
Mosul	11,416	717,500	Mosul
Muntafiq	5,714	455,644	An Nasiriya
Sulaimaniya	3,685	299,978	Sulaimaniya
<i>Desert administrative districts</i>			
al-Jazira Desert	12,056		
North Desert	39,127		
South Desert	29,399		

2. THE PEOPLE

The population of Iraq is not particularly homogeneous. Divided by native language, it breaks down roughly into 79 per cent Arabic, 16 per cent Persian, and 2 per cent Turkish. Arabic is the official language; English is widely spoken as a second language among commercial, professional, and governmental personnel. Over 90 per cent of the total population are Muslims (Moslems), a little more than half of whom belong to the Shi'ite sect rather than the orthodox Sunni group. The latter consists, generally speaking, of the Arabs of the north, the Bedouins, the Kurds, and the inhabitants of Baghdad and Basra. The Shi'ites are concentrated among the Arabs of the south and the Persian-speaking groups. They are especially associated with the holy cities of al-Najaf, Karbala, and Kadhiman (al-Kāzimayn). Christians, who numbered 150,000 in 1947, are mainly of Nestorian, Jacobite, and Gregorian sects. Most of the 118,000 Jews listed in the 1947 census have emigrated to Israel; in 1958 only about 10,000 remained in Iraq. In addition to the linguistic and major religious divisions there are other isolated and fossilized groups such as the Ma'dan, marsh dwellers of the south; the Sabaeans; and the fire-worshipping Yazidis of the north. See also ASIA—6. *Languages* (Southwest Asia); MOSLEM SECTS.

3. THE LAND

Iraq is composed of three main geographical divisions: steppe and desert in the south and west, lowland and plain in the Tigris-Euphrates Valley, and highland and mountains in the north and northeast. The physical scene is dominated by two long and inundating rivers, the Tigris and the Euphrates, both of which rise in Turkey. They follow courses of 1,150 and about 1,700



Chapelle from Monkmeyer

Iraqi children, including a baby in a burlap crib.

miles, respectively, and join to form the 115-mile Shatt-al-Arab, which empties into the Persian Gulf. In their lower courses water may be conducted from one river to the other, thereby increasing facilities for irrigation. With the melting of snow at their sources, both rivers begin to rise in the spring, reaching their maximum in April and May. Vast areas are thus regularly inundated, but at times floods go out of control and cause considerable damage. Modern flood-control projects, such as the Wadi Tharthar overflow, will, however, probably completely eliminate destructive floods. This inundation compensates for the scarcity of rain, which averages less than 10 inches annually. In Baghdad the average rainfall is only 5.9 inches; in Mosul, 14.6 inches. The northeast highlands receive 15 to 25 inches. In summer the shade temperature exceeds 110° F. For July and August, the two hottest months, Baghdad averages 92°; for January, 48.8°.

These physical conditions have hindered the natural growth of population, interfered with communications, and isolated certain communities. Roads are subject to destruction by sudden floods, and in their higher reaches the rivers are navigable only downstream. Only 3 per cent of the total area of the country is cultivable. Unirrigated sections are almost devoid of vegetation, but along the river banks and canals date palms grow in abundance. In addition to the world-renowned fruits, the palms yield construction materials and fuel. Poplars are also conspicuous.

4. ECONOMIC DEVELOPMENT

Agriculture.—Some 80 per cent of the people of Iraq derive their living directly or indirectly from the soil. Nomads, seminomads, and sedentaries also raise a variety of crops. Barley and wheat are the staples. Other cereals include rice, corn, millet, and sorghum. Aside from dates, fruits comprise pomegranates, oranges, apples, apricots, and lemons, which grow largely in north-

ern and northeastern areas. It is estimated that over 18 million date palms of fruitbearing age, mostly along the Shatt-al-Arab, make Iraq the world's largest producer of dates; the country is responsible for some 80 per cent of the commercial supply. Some nuts and olives are also produced, and between 1951 and 1956 annual cotton output ranged from 1,000 to 8,000 tons. Tobacco is also grown.

Industry and Trade.—Oil is the only mineral extensively exploited and this industry ranks first in Iraq. In 1955 the total production was 33,149,200 long tons; 1956 production dropped to 29,469,100 long tons because of pipelines cut in the Suez crisis. The oil operations are, with minor exceptions, carried on by the Iraq Petroleum Company, Ltd. (IPC) and its subsidiaries, the Basra Petroleum Company and the Mosul Petroleum Company. The IPC concession dates from 1925;¹ revised in 1952, it provides for a "50-50" split of profits between the government and the company. Based on annual production of 30,000,000 tons, Iraq receives approximately \$200 million per year. Oil is exported by tanker from Basra and by pipelines to the Mediterranean coast. A 12-inch pipeline from Kirkuk to Haifa, Israel, and one from Kirkuk to Tripoli, Lebanon, were installed in 1934, but the Haifa line has not been in operation since the establishment of Israel in 1948. An additional 16-inch line to Tripoli was opened in 1949. In 1952 a 30-inch line from Kirkuk to Baniyas, Syria, was opened. Syrian sections of these pipelines were blown up during the Suez crisis of November 1956.

Other industries in Iraq are of relatively minor importance, but include the supplying of electricity and water, and the manufacture of bricks and cement. There are also food processing industries, such as breweries and date packing; cigarette, spinning and weaving, chemical, furniture, clothing and metalworking industries. However, out of a total of 22,460 establishments employing 90,291 workers in 1954, only 294 employed more than 20 persons.

Oil is obviously the chief export (\$438,796,000 in 1956), followed by barley (\$13,958,000), dates (\$6,952,000), wool (\$4,408,000), and six other products (total \$6,440,000). The principal imports are machinery, iron and steel products, motor vehicles and parts, textiles, wheat, sugar, and tea. In 1956 imports totaled \$317,520,000.

Transportation and Communications.—Historically, internal water transportation has played an important role in Iraq's economy. The Tigris is navigable by shallow draft vessels from Basra to Baghdad, and with difficulty by small craft as far as Mosul in the high-water season. The Euphrates is navigable to a very limited degree, but in any case alternate methods are making most water transport obsolete. The port of Basra is of key importance and in 1954 handled 1,219,117 metric tons of cargo. Both Baghdad and Basra enjoy modern airport facilities, and in mid-1957 a new Baghdad airport was begun. The government-owned Iraqi Airways operates throughout the Middle East and to Europe. In 1958 some 12 other airlines, including 2 United States lines, served the country. The Iraqi State Railways operate a meter-gauge line 691 miles long, con-

necting Basra with Erbil via Baghdad and Kirkuk, and a standard-gauge line 403 miles long running from Baghdad and connecting with the Syrian system via Mosul. Highways have until recently been mostly unsurfaced dirt roads subject to frequent washouts in winter, but a number of major bridges and roads have recently been completed or are under construction. A 1956 estimate was that Iraq had 1,800 miles of hard-surfaced roads (of which the longest is that from Baghdad to Jordan) and 5,000 miles of unimproved roads. The new projects link the major cities and total approximately 1,500 miles in length. Five major bridges have recently been completed, and others are contemplated. Baghdad is the only major Arab city boasting television; sets numbered 600 at the end of 1956. See also BAGHDAD RAILWAY.

The Development Board.—Most of the new, large-scale development projects in Iraq, such as roads, bridges, airports, and river control, have been carried out under the aegis of the Economic Development Board. Created in 1950, this board is a tremendous new force in the country. By law, 70 per cent of all oil income is allocated to the board to finance its projects, and, according to plan, the board expected to spend some \$1,400 million in the six-year period of 1955-1960. About 30 per cent of this vast sum was allocated to river control. The purpose is to provide water for irrigation, to prevent devastating floods and, to a lesser degree, to provide for hydroelectric power. Irrigation by modern methods began as long ago as 1908, when the Hindiya Barrage was begun. Other works followed, but the Development Board's plans overshadow everything else. The four main river projects are: the Samarra Barrage, which diverts water into the Wadi Tharthar depression to the southwest (completed spring 1956); the Habbaniya (Habbāniyah) Reservoir, including the Ramadi Barrage (completed in 1956); the Dokan (Dūkān) Dam (construction began in 1957, completion planned for 1958); and the Derbendi Khan (Darbandi Khān) Dam (projected for completion in Iraq at a cost of over \$50 million. It is believed that these four projects will give ample protection against floods and suffice for irrigation needs. There has been, however, some criticism of the board for neglecting aspects of agricultural development, such as rural extension services. Other areas getting massive support from the Development Board are transportation (roads, bridges, railroads, ports, and airports); industry, mining, and electricity; public housing and public buildings.

5. GOVERNMENT

Prior to the revolution of July 1958 the Iraqi government was an hereditary constitutional monarchy on the British model with authority vested in the noble Hashemite family of Hejaz. After some days of martial law, the republican government announced a provisional constitution under which the country would be run by a sovereignty council composed of three members. The Council of Ministers was empowered to legislate as well as to assume executive powers. The constitution also provides for Islam as the state religion, freedom of worship and expression, the maintenance of private property, and an independent judiciary.

Each of the 14 *liwas* into which the country is divided is under a governor (*mutasarrif*) responsible to the minister of the interior. Each *liwa* is divided into a number of *qadas* (districts),

¹The ownership of IPC comprises: Standard Oil Company of New Jersey, 11.875 per cent; Socony-Mobil Oil Company, 11.875 per cent; British Petroleum, 23.75 per cent; Royal Dutch Shell Company group, 23.75 per cent; and the estate of the late C. S. Gulbenkian, 5 per cent.



Above: Baghdad on the Tigris. In the 9th century Caliph Harun-al-Rashid of "Arabian Nights" fame made it the most splendid city of Islam. Today, capital and chief city of Iraq with over a million inhabitants, it has a modern aspect while retaining mementos of its colorful past.

IRAQ

Right: Few women in Iraq can read and write, and almost as few men. To help the great masses of the people who are still illiterate, a scribe sits outside every post office and sells his service to all comers.



(Above) Lawrence Griswold from Black Star; (right) Lindt from Black Star; (below) Wide World Photo

Below: Camel caravan, en route to Baghdad, follows the pipeline route across the deserts of Iraq. But the camel is gradually yielding to the motor truck, propelled by gasoline from the rich oilfields near the Persian Gulf.





Above left: Even ancient Baghdad has been invaded by modernity. On Rashid Street, the city's main thoroughfare, is this new apartment house with its interesting rounded balconies.

Above right: The gold-domed Kadhimain Mosque in Al-Kadhimain, Baghdad Province, shelters the tombs of two imams, or high priests.

(Above left) Wide World Photo; (above right) Marie J. Mattson from Black Star; (others) Authenticated News

Center left: A statue of the Sumerian high priest Du-Du, carved some 4,600 years ago. Excavations are continually bringing to light such relics of ancient Mesopotamian culture.

Center right: White marble statues of the Sumerian god Abu and his consort. Found at Tell Asmar, a rich archaeological site, they date from the early dynastic period of about 2800 B.C.

Below: Excavations at Eridu revealing the remains of a pyramidal temple tower which dates from the period 4000-2000 B.C.



and these in turn into *nāhiyahs*.

Justice is administered by courts of various grades. In addition to civil courts, which handle civil, criminal, and commercial cases, there are religious courts that deal with matters of personal status, such as marriage, divorce, inheritance, and adoption.

Military service is compulsory for all men between the ages of 18 and 25 and lasts from 18 months to 2 years. Iraq is defended by the army, air force, police, and a small navy. A volunteer "people's resistance" organization was formed by the republican government.

6. EDUCATION

Education in its early stages is free but lacks adequate facilities for universal implementation.¹ In 1959-1960 there were 3,228 primary schools and 362 secondary schools with a combined enrollment of 762,820; also 5 institutions of higher education with over 12,000 in attendance. Slightly under 25 percent of recent budgets is allotted to education. In secondary education a distinction is made between curricula for girls, which stress child care and domestic science, and those for boys, of which scientific, literary, and commercial courses constitute the core.

Although it has lagged somewhat behind some other Arab states in the establishment of a university, nevertheless a number of separate faculties were developed after World War I, and the government of Iraq, by an act of Parliament of June 1956, united them as the University of Baghdad. It includes the following major divisions: arts and science, fine arts, medicine, Muslim law, agriculture, commerce and economics, engineering, scientific and industrial research, higher teachers' training, law, Queen 'Aliyah College for girls, and veterinary science. A second university, al-Hikmah, run by American Jesuits, and an outgrowth of their secondary school, Baghdad College, is also in Baghdad. Newspapers and periodicals are published, mostly in Baghdad, and there are a number of libraries and important museums, also located in the capital.

7. HISTORY

Mesopotamia, as Iraq was formerly called, was one of the earliest seats of culture. The nomadic Semites who moved there about 3500 B.C., presumably from the Arabian Peninsula, encountered an already high civilization, that of the Sumerians, who lived in homes, cultivated the land, and possessed a highly developed system of writing known as cuneiform. Those Semites who settled in the southern part of the country became known as Babylonians, after their capital city of Babylon; those in the north were Assyrians, with Nineveh (near modern Mosul) as their capital.

For a detailed account of the ancient history of Mesopotamia, see *ARCHAEOLOGY—Old World*; *ASSYRIA*; *ASSYRIOLOGY*; *BABYLONIA*; *MESOPOTAMIA*; *MIDDLE EAST*; *ORIENTAL ARCHAEOLOGY—Mesopotamia*.

In medieval times, Iraq was the seat of the Abbasid ('Abbāsīd) caliphate, the longest lived (750-1258) and best known of all Muslim caliphates. It enjoyed its golden age under Hārūn al-Rashīd (r. 786-809), of *Arabian Nights* fame, and his son al-Ma'mūn (r. 813-833). Under these two rulers, Baghdad was the center of a transla-

tion movement, mainly from Greek, which embraced the major works in philosophy, medicine, mathematics, astronomy, and geography. Following their reigns, the caliphate began to disintegrate. See also *ABBASIDS*; *ARAB PHILOSOPHY*.

With the capture of Baghdad in 1258 by the Mongol Hulagu and the attendant massacre of the population and destruction of the canals, the country entered upon a period of decline that reached its nadir under the Ottoman Turks. The 380-odd years of Ottoman rule were characterized by wars with Iran, raids from the desert, sectarian disputes, and quasi-independent local chiefdoms. The enlightened but brief governorship of Midhat Pasha (1869-1872) did not suffice to reverse the tide of degradation. By the time of World War I some Iraqis, especially army officers, were infected with the Western nationalistic ideology.

The modern history of Iraq begins when the British took it from the Turks in World War I and subsequently established a British mandate. In 1921 Faysal (Faisal), third son of King Ḥusayn (Husayn ibn-'Alī) of the Hejaz was, with full British approval, proclaimed king of Iraq. A moderate, he led the fledgling state cautiously but persistently toward independence. The first Parliament met in 1925. In 1932, Iraq was admitted to the League of Nations and thus obtained formal recognition as an independent sovereign state. A 1930 treaty with Great Britain had replaced the mandate and provided, among other things, that Britain could keep two airbases in the country. In 1933 Faysal was succeeded by his son Ghāzi I, who was killed in an automobile accident after a reign of six years. Thereupon, Ghāzi's infant son Faysal was proclaimed his successor under the regency of his maternal uncle 'Abd-al-Ilāh. In 1953, on attaining his majority, he was enthroned as Faysal II and reigned until his assassination in 1958.

The newly independent Iraqi state had considerable difficulty in stabilizing itself. The Assyrian troubles of 1933, and the tribal revolts of 1935-1936 were both symptomatic. There was, in addition, rising feeling against Great Britain because of its sponsorship of Zionism in Palestine—feeling which was increased by the propaganda barrage from Nazi and Fascist sources. Several coups d'état culminated in the brief pro-German coup of Rashīd 'Alī al-Gailani in 1941. Expected Nazi help did not arrive in quantity, and British forces put down the uprising with little difficulty. Thereafter Iraq observed the terms of the Anglo-Iraqi alliance of 1930, and in 1943 declared war on the Axis. In 1945, Iraq became a charter member of the United Nations.

Another international organization in the founding of which Iraq, under the leadership of its veteran premier Nūrī al-Sa'īd, played a leading part was the Arab League (q.v.). As Egypt became the leader of a "neutralist" orientation in the Arab world, Iraq was identified as the leader of the pro-Western policy. In February 1955, Iraq signed an alliance with Turkey; Great Britain, Pakistan, and Iran followed suit in subsequent months, thus completing membership in the Baghdad Pact, so called because its permanent secretariat was established in that city. The United States, although a member of various committees, was not a formal member of the alliance.

The Anglo-French-Israeli invasion of Suez in November 1956 almost sundereed the pact because of the depth of pan-Arab feeling in Iraq, but the

¹ In 1947, 89 percent of the sedentary population over 5 years of age was illiterate. The percentage is doubtless declining steadily.

government emerged committed to the West and also to common Arab ideals. These ideals were, however, exploited more effectively by President Gamal Abdel Nasser (Jamāl 'Abd-al-Nāṣir) of Egypt. When, therefore, Syria and Egypt united as the United Arab Republic (Feb. 21, 1958), Iraq hastily formed (May 12) with the Hashimite Kingdom of Jordan a new merger, the Arab Union. On July 14 a military coup headed by Abdul Karim Kassem ('Abd-al-Karīm Qāsim) killed Nūrī al-Sa'īd, King Faysāl, and his uncle regent, and proclaimed a republic with Kassem as premier. The new regime banned political parties, withdrew from the Baghdad Pact, and accepted financial and technical aid from the Soviet Union. In June 1961, Kassem laid claim to Kuwait on historical grounds, but received no support from other Arab states; and when their league admitted Kuwait, Iraq boycotted it. Because the United States recognized Kuwait's independence, Kassem broke off diplomatic relations on the ambassadorial level. Meanwhile, the Kurds, who formed about 15 percent of an estimated (1960) 7,085,000 population, were intensifying their rebellion in the north and straining the financial and military resources of the republic. Syria's secession from the United Arab Republic in September 1961 drew it closer to Iraq, which in June 1962 signed a trade agreement with it.

On Feb. 8, 1963, another military coup, headed by Col. Abdul Salam Aref ('Abd-al-Salām Arif), destroyed the Kassem regime and the following day executed him by a firing squad. Aref was a deputy of Premier Kassem's but belonged to the Socialist Ba'th (Baath, renaissance) Party which favored union with Egypt. After the Baathists fell out with Nasser in May, Aref broke with them and seized control himself, with army support, in November.

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IREDELL, ir'dēl, James, American jurist: b. Lewes, England, Oct. 5, 1751; d. Edenton, N.C., Oct. 20, 1799. He migrated to America in 1768 as comptroller of the customs at Edenton. Meanwhile, he studied law and was licensed in 1771. From 1774 to 1776 he served as collector of the port of Edenton, and in 1777-1778 as judge of the state superior court. He was attorney general of North Carolina from 1779 to 1781, and in 1787 was elected to the Council of State. As a

delegate to the convention of 1788, he supported ratification of the federal Constitution. He was appointed to collect and revise the acts of the legislature; his *Revisal* was published in 1791. From 1790 until his death he served as associate justice of the United States Supreme Court, for which he wrote a number of notable opinions, the best known of which, in *Chisholm v. Georgia*, ably defended states' rights.

IRELAND, ir'länd, John, American prelate: b. Burnchurch, County Kilkenny, Ireland, Sept. 11, 1838; d. St. Paul, Minn., Sept. 25, 1918. In 1849 he emigrated to the United States with his parents, who settled in St. Paul in 1853. He was sent to France to study theology at the seminaries of Meximieux and Hyères, and following his return to St. Paul in 1861 he was ordained in the Roman Catholic priesthood. In 1862-1863, during the early stages of the American Civil War, he served as a chaplain in the Union Army. He was appointed rector of the cathedral at St. Paul in 1867, and in 1875 he became coadjutor bishop. In 1884 he was made bishop, and in 1888 he was consecrated the first archbishop of St. Paul. He was influential in securing the founding of The Catholic University of America in Washington, D.C., and a leader in the spread of parochial schools in the United States.

IRELAND, William Henry, English literary forger: b. London, England, 1777; d. there, April 17, 1835. He imposed spurious Shakespearean manuscripts upon his father, Samuel Ireland, a bookseller and engraver, who was a Shakespeare enthusiast, and also upon other men of letters. These documents included a transcript of *King Lear*, extracts from *Hamlet*, and the pseudo-Shakespearean plays *Vortigern* and *Rowena* and *Henry II*. *Vortigern* was purchased by Richard Brinsley Sheridan and produced by him in 1796 at Drury Lane, where it proved to be a complete failure. The forgeries were detected by Edmund (Edmond) Malone (q.v.), and Ireland acknowledged the fraud in his *Authentic Account of the Shakespearean Manuscripts* (1796); in his *Confessions* (1805) he gave a more detailed account of his forgeries, removing the suspicion that his father may have been an accomplice. *Vortigern* and *Henry II* were published in 1799, and *Vortigern* again in 1832. He also wrote several original romances, ballads, and narrative verse. Ireland's career formed the basis of a novel by James Payn, *The Talk of the Town* (1885). His father's correspondence concerning the forgeries, as well as some of the specimens of the latter, are in the British Museum.

IRELAND, an island, separated from England on the east by the Irish Sea and St. George's Channel, covers 31,840 square miles, of which 26,602 square miles are in Eire (Republic of Ireland) and 5,238 square miles in Northern Ireland. (See IRELAND, REPUBLIC OF; NORTHERN IRELAND.) It is divided into 32 counties, formed gradually from the 11th to the 16th centuries. These counties are by tradition grouped into four provinces as follows—LEINSTER PROVINCE: Carlow, Dublin, Kildare, Kilkenny, Leix or Laoighis (formerly Queen's County), Longford, Louth, Meath, Offaly (formerly King's County), Westmeath, Wexford, Wicklow; MUNSTER PROVINCE: Clare, Cork, Kerry, Limerick, Tipperary, Waterford; CONNACHT (or CONNAUGHT) PROVINCE:

Galway, Leitrim, Mayo, Roscommon, Sligo. ULSTER PROVINCE includes three counties of Éire—Cavan, Donegal, and Monaghan—and the six that form Northern Ireland—Antrim, Armagh, Down, Fermanagh, Londonderry (or Derry) and Tyrone. Confusion is caused by the fact that the word "Éire" is the Irish for Ireland and may, with equal validity, designate the entire island or the 26 southern counties; while "Northern Ireland" is often referred to as "Ulster" though it consists only of six out of the nine counties within that province.

Topography.—Most Irish views include mountains as at least a distant background in the landscape, and it is the variety of scene that gives the country its scenic attraction. There are no mountains of great height, and the loftiest, Carrauntoohill (Carrantuohill), 3,414 feet, is in the Reeks of Kerry (Macgillcuddy's Reeks): but in several of the major mountain ranges deep valleys, heath-covered moorlands, and occasional lakes combine to give an impression of rugged grandeur. Nowhere is this more vividly seen than in the extreme west of Connacht, where the Twelve Bens (misnamed Pins) of Bunnabeola in Connemara rise to over 2,000 feet above many square miles of peat bogs on ground only 100-200 feet above sea level. In Achill Island, similar sharp hills over 2,000 feet high rise precipitously from the sea itself; and Slieve League, in the extreme southwest of Donegal, is equally impressive. Several of the mountainous parts of Ireland, visited most by tourists, are close to the sea. In Donegal, western Connacht, and Kerry, mountain ranges are penetrated by long marine inlets, varied in form but everywhere making a scene of great beauty. In the east, the major range is the Leinster chain, which extends for 70 miles southwestwards from Dublin, parallel to the coast: this range has various local names, such as the Dublin Mountains (near the city), the Wicklow Mountains (in the county of the same name), and the Blackstairs Range. The highest peak is Lugnaquilla, 3,039 feet, and there are several fine valleys such as Glendalough, as well as high-lying moors of wide extent. The Mourne are a sharp range in County Down, which rise to 2,796 feet in Slieve Donard direct from sea level: the range has some remarkable deep valleys. North of Belfast, there is an upland, the Antrim plateau, mostly 1,000-1,500 feet high but intersected by several valleys known here as "glens" and separated from the sea only by a very narrow lowland traversed by the Antrim coast road. Less spectacular but interesting plateaus are formed of Carboniferous rocks in the Castletomer upland (between the Barrow and Nore rivers), the uplands on either side of the lower Shannon (parts of counties Cork, Limerick, and Kerry, and those to the west of County Clare), and a group of uplands in County Sligo and adjacent counties. These plateaus are mainly 1,000-2,000 feet high and include among their strata some of coal measure age, though most of these are unproductive and only in Castletomer is there any mining of significance.

Physical maps reveal at once that the uplands of Ireland have two marked trends. In the extreme south, the hills run east-west, finally reaching the Atlantic in a series of peninsulas: elsewhere, however, the hills run from northeast to southwest, as in the Leinster chain, the Slieve Bloom, and other ranges in the southern half of

Ireland, in the Mourne Mountains, and in the sharp-peaked ridges of the northwest. Around the mountains there are lowlands, covering in all more than three quarters of the whole island. The greater part of these lowlands is floored by Carboniferous rocks, but some are developed on earlier strata, and their variety of surface form is due to a complex glaciological history. Almost the whole area of Ireland was covered by ice at some phase in the Quaternary Ice Age, and drifts of varying thickness, some very shallow but others as much as 200 feet deep, occur over large areas: in the lowlands north and south of Galway Bay, however, drifts are absent and remarkable expanses of bare limestone are seen, some devoid of vegetation, but others with low-growing hazels and occasional ash trees. A major effect of the glaciation was the disorganization of the drainage, for peat bogs were formed widely in the Central Lowland and lakes filled hollows, of which some had been ground out by the ice and others lie between various glacial deposits. And not the least remarkable feature is a belt of drumlins (see *Geology*, below) occurring mainly in a band of country 50 miles wide from the Ards Peninsula (south of Belfast Lough) westward to Clew Bay, County Mayo, with extensions through the Erne Valley to Donegal Bay. They are also numerous in the Bann Valley.

Coastlines are varied in form. In the east there are rocky shores and cliffs, some of which have splendid exposures of glacial drift. Wexford Harbour, Dublin Bay, Carlingford Lough, Strangford Lough, and Belfast Lough are the major inlets; at various points along the coast there are sand dunes. The south coast has several long inlets—two of which form the harbors of Waterford and Cork: much of the coast has cliffs some 200 feet high, broken by numerous estuaries and coves. In the west, there is some magnificent coast scenery. Western Cork and Kerry consist of peninsulas with hills, some of which terminate in high cliffs, and islands add variety to the scene. The long estuary of the Shannon is tidal to Limerick, 50 miles from the open sea. County Clare has some fine cliffs, notably the Cliffs of Moher, which have a vertical drop of 600 feet. Limestones in north Clare and in the Aran Islands are exposed in horizontal slabs, seared by weathering into pavements. In Galway Bay, there is a marked contrast between the limestones to the south and the ancient metamorphic rocks to the north; and in the west there are numerous islands. This scenic type is continued northwards to Clew Bay, where the drumlins, at the western extremity of their great spread across Ireland, appear as a multitude of islands. Quartzites, highly resistant metamorphic rocks, form massive precipices almost 2,000 feet high in Achill Island and in the southwest of County Donegal; but otherwise the coasts of this area are varied in form, though including numerous cliffs. Four long inlets of County Donegal—Lough Foyle, Lough Swilly, Mulroy Bay, and Sheep Haven—add to the variety of an intricate coastline. As a whole, the coasts of Ireland are remarkable for their scenery and variety.

Hydrography.—Rivers have complicated courses in Ireland, due to an involved geological history and the deposition of large quantities of glacial drift. A puzzling feature is that certain rivers flow over the Central Lowland in courses almost level, and then fall rapidly to sea level in their last few miles. The Shannon, for example,

falls 100 feet in the last 16 miles from Lough Derg to the tidal level at Limerick, and there is a similar fall at Ballyshannon, on the Erne: both these falls have now been used for hydro-electric stations. Several other rivers, such as the Liffey, the Barrow, and the Nore, flow through gorges for many miles before they reach the sea.

The Shannon, the longest river in the British Isles, rises in the Carboniferous uplands near Sligo Bay, falls steeply to Lough Allen (164 feet), and then flows gently across the lowland; it passes through several lakes, of which the two largest are Lough Ree and Lough Derg. Its three major tributaries, the Suck, Inny, and Brosna, are similar slow-flowing lowland rivers. The Erne, which flows to Donegal Bay, is a river draining an intricate drumlin country marked by numerous lakes, of which the two largest are upper and lower Lough Erne. In the north, the Foyle-Strule river system consists of one main stream and several tributaries; the Bann rises on the north side of the Mourne Mountains, and flows northward, including in its course Lough Neagh (150 square miles), the largest lake in the British Isles. The Boyne and its tributary the Blackwater drain eastern parts of the Central Lowland, and the Liffey rises in the Leinster chain and winds round the west side of these mountains to reach the sea at Dublin. Only one river, the Slaney, cuts through the Leinster chain.

The rivers of the south and southeast have courses of great interest. The streams flowing to Waterford Harbour—the Barrow, Nore, and Suir—pass through peat bogs on wide lowlands in their upper courses, but entrench themselves in gorges as much as 100 feet deep nearer the sea. From a point near Clonmel, the Suir has an west-east course, a feature seen also in rivers still farther south—the Blackwater, its tributary the Bride, the Lee and (another river) Bride at Cork, the Bandon, and numerous smaller streams. All these rivers flow in valleys between the east-west chains of mountains to which reference has already been made: the Blackwater and the Lee turn south and reach the sea in striking estuaries. Most of the remaining rivers are short and insignificant.

As a whole the rivers of Ireland have great interest for the physical geographer: in the Central Lowland they are sluggish, slow-moving streams bordered in places by extensive peat bogs, but in the lower reaches they are swifter-moving, pleasant stretches of water. Few visitors trouble to explore these valleys, but the Foyle, the Boyne in County Meath, the "three sisters" (Barrow, Nore, and Suir) which unite in Waterford Harbour, the Blackwater, and, to quote Edmund Spenser, "the spacious Shenan (Shannon) spreading like a sea," all have their distinct beauty.

Geology.—The oldest areas of Ireland are the pre-Cambrian masses, comparable to those of the Scottish Highlands, in the northwest (counties of Donegal, Londonderry, and Tyrone) and in the west of the Connacht Province (western Mayo and western Galway). Within these areas, there are varied rocks, including gneisses, schists, granites, and quartzites; and it is the last of these that form some of the striking hills, including some sharp conical peaks such as Errigal in County Donegal, Nephin in County Mayo, the Twelve Bens (or Pins) of Connemara, and the Maamturk Mountains, both in County Galway.

As a whole, these areas of ancient rocks include both mountains and lowlands in a complex intermixture, and additional topographic variety is given by the marine inlets and fragmented coast-lines.

Caledonian mountains, formed by earth movements in Silurian and Devonian times (over 300 million years ago), include the ranges of County Donegal and County Derry, where the hills have a clearly-marked northeast-southwest line: seen especially in the Sperrins, in Donegal it is accentuated by the existence of deep valleys between each range. In County Sligo, the Ox Mountains have the same northeast-southwest trend, but it is less clear in County Mayo and County Galway. On the east side the hills from the south of Belfast Lough inland almost to the Shannon have the same trend, but there are few sharp ranges except for the Mourne Mountains of County Down, where granites of a late date (Tertiary) formed a line of hills having the same Caledonian northeast-southwest line. In the southeast, the Caledonian movement was accompanied by an uprising of granite, and the Leinster chain (parts of which are also known as the Wicklow Hills, the Blackstairs Mountains, and Mount Leinster) consists of a vast anticlinal arch: after many millennia of erosion, the granites have been exposed in the center and the Silurian and older rocks left on either side. The Caledonian ranges have numerous peaks over 2,000 feet, and in County Wicklow, Lugnaquilla, as has been noted, is 3,039 feet high: the northeast-southwest line is a major feature in the physical geography of Ireland, not only in the west but in the east, particularly in the Leinster chain, which is broken as a range by only one river, the Slaney.

After the mountain-building storms, a period of slow accumulation followed in which Devonian and Carboniferous strata were laid down. Some of the Devonian beds, known as Old Red sandstones, were later to offer great resistance to erosion, greater in fact than either the older Silurian and Ordovician beds or the newer Carboniferous strata. A further mountain-building period, the Armorican, followed in Carboniferous and Permian times, and some remarkable mountain ranges were formed in consequence. Of these, the clearest are the long east-west lines of hills which extend from County Waterford to the peninsulas of Kerry: in these ranges the highest ground is formed of the Old Red sandstones—mentioned above as strongly resistant to erosion. In these ranges there are some high peaks, including Carrauntoohil (Carrantal), 3,414 feet, the highest point in Ireland, and Galtymore, 3,018 feet. Where the Old Red sandstones have been removed by erosion, upland basins exist, flooded by older Silurian and Ordovician rocks: the Comeragh Mountains formed of Old Red sandstone, for example, rise as a craggy range above such an upland basin. In the valleys, Carboniferous limestones are exposed. In the extreme south, the Old Red sandstones exist in ridges, 600-800 feet high.

South of a line drawn from Dungarvan to Dingle Bay, the Armorican ranges are continuous from east to west except for a few gorge-like stretches of river valley, notably that of the Blackwater from Cappoquin to Youghal. Many of the rivers flow in west-east valleys for the greater part of their course; and the Blackwater is an excellent example. North of the Dungar-

van-Dingle Bay line, the ranges are isolated from one another by extensive lowlands: these include the Slievenaman Range, the Comeraghs, the Knockmealdowns, the Galtee Mountains and the magnificent ranges of the Dingle peninsula. In structure these ranges are similar to those farther south, but the intermingling of lowlands makes them even more impressive in appearance. Everywhere the east-west line prevails, and is as marked a feature of Irish topography as the northeast-southwest line of the Caledonian folds.

In one long and variously named series of hills, extending from the neighborhood of Limerick, where it is called the Slieve Felim, to the Slieve Bloom, near Maryborough, Armorican ranges of similar structure to those farther south are aligned from northeast to southwest—that is, parallel with the Caledonian chains. Grenville Cole suggested that these Armorican mountains have been folded over previously-existing Caledonian chains.

Carboniferous rocks cover over half the area of Ireland. There is a full range of strata: over most of the country, Carboniferous limestones occur, and all the younger strata have been removed, but three plateaus of coal measures, millstone grits, and upper limestones remain. Of these, the first is the Castletomer—Slieve Ardagh plateau; the second, the Munster "coalfield" extending from Killarney to Galway Bay; and the third, the plateaus extending from County Sligo to County Monaghan. Although coal measures form part of these plateaus, they contain very little coal. The Castletomer—Slieve Ardagh area has limited resources of anthracite, but in the so-called Munster coalfield, the seams are thin, heavily faulted, and almost valueless. There is a small coalfield in the third plateau area, in the Arigna district beside Lough Allen. As elements in the landscape of Ireland, these plateaus are of no particular attraction: but they have long even skylines of considerable interest. The Castletomer plateau is some 1,000 feet high and the Slieve Ardagh (separated from Castletomer by the Nore Valley) reaches similar altitudes. The Munster plateau is divided into two by the Shannon, and on the south has long even skylines, 1,000-1,200 feet high, rising to over 1,400 feet; in County Clare, hills of similar height exist. The Sligo-Monaghan plateaus are divided into a number of parts by deep valleys, above which they rise to 1,500-2,000 feet.

The Central Lowland of Ireland is floored almost entirely by Carboniferous limestone: much of it is 200-400 feet high. It extends from the shores of County Dublin across the country to Galway Bay and Clew Bay. Everywhere except in a belt of lowland extending north and south from Galway Bay, these limestones are covered with glacial drifts: this driftless area includes some remarkable limestone pavements.

In the northeast the Triassic, Liassic, and Cretaceous beds were laid down, but they are exposed at the surface only in a few places, notably the Lagan Valley. Elsewhere they are covered with basalts, poured out in Tertiary times in a series of flows 15-20 feet thick and covering in all some 1,500 square miles. From the Antrim coast road to the north of Belfast, it is possible to see the Cretaceous chalks, Liassic clays, red Triassic marls, and sandstones beneath the cover of basalts: blocks of basalt have slipped from the escarpment over the underlying strata. This northeastern area consists of plateaus and wide low-

lands: the edge of the plateau is clearly seen in Cave Hill and Divis, immediately to the west of Belfast and in the plateau of County Antrim farther north, but in the lower Bann Valley basalts underlie lowlands. The most spectacular outcrop of the basalts is the Giant's Causeway, County Antrim, where hexagonal basalts are exposed on the coast: here it is possible to walk for several miles beside a remarkable series of cliffs, which have a lower layer of regular, hexagonal columns and an upper layer of thin irregular prisms molded into fantastic shapes and called by such names as the Giant's Organ.

The last—and in many ways the most important—phase in the geological history of Ireland was its glaciation. Two main icesheets left limestone-bearing drift over large parts of the Central Lowland: in the northeast the drifts are derived partly from Scottish sources and also include some basalt and chalks of local origin. There were also various mountain glaciations, some of small extent but leaving (for example, in the Comeraghs and the Reeks of Kerry) a number of wonderful corrie basins. Other mountain glaciations were larger: those of the Wicklow Mountains, for example, carried ice far from the center of the hills, and an even greater ice-sheet which covered the mountains of Kerry and western Cork extended to the eastern limit of County Cork; the drifts are largely sand and gravel. A few small areas of Ireland were apparently never covered by ice, but almost everywhere else the soils and surface drainage are affected by the glaciation.

Glaciation has affected the physical geography of Ireland in various ways. In parts of the west, notably in Connemara (the area west of Galway), the ice apparently removed the soil and left bare rock surfaces—much as it did in parts of Canada or of Finland—but over most of the lowland there is an accumulation of drift, molded into drumlins in a wide belt of country extending from Belfast Lough and the neighborhood of Dundalk westwards to Donegal, Sligo, and Clew bays; and there are also isolated swarms in the lower Bann Valley, various lowlands of north and west Donegal, and, far to the south, in Bantry Bay. Drumlins, it has been estimated, cover one eighth of the surface of Ireland: some are of considerable size, even as much as a mile long, but many are 400-500 yards long and half as broad. These "little hills" are generally 50-100 feet high—but only a few of them have been penetrated by cuttings and some may have a rock core. Normally the true "drumlin" is thought to consist entirely of drift, but many hills that look like drumlins may be due to the deposition of drift on a rock surface.

As the last icesheet decayed, vast quantities of water were liberated and the surface drainage of the country was restored. Meltwaters formed some remarkable channels in and around various uplands: in the Wicklow Mountains, for example, there are over 100 meltwater channels, some quite small but others hundreds of feet deep though now occupied only by small "misfit" streams. In this case ice on either side of the mountains prevented the escape of meltwater to the east or west, and so channels were cut in a north-south direction, parallel to the trend of the mountains. And the channels of other ranges, such as the Mourne, the Carlingford, and the Sperrins, are almost as spectacular. It is, however, the eskers of the lowlands that have excited the greatest curiosity. These are long sinuous ridges stand-

ing at least 20-30 feet above the surrounding countryside; they exist in east-west and in north-south lines across the central lowland. Their origin has been ascribed to deposition of gravel and sand in streams beneath the icesheet, to the formation of deltas in standing water at the margin of an icesheet, and to various other causes. They are interesting features of the Irish central lowland; in some places they are surrounded by peat bogs.

Soils.—As yet, there has been comparatively little soil analysis in Ireland, though the importance of this subject in an agricultural country was recognized as long ago as 1907, when J. R. Kilroe published his *Soil Geology of Ireland*. He showed that most of the Irish soils originate from drifts and were varied in quality, here sandy and there clayed: where drifts did not occur, some of the older rocks, such as quartzites, certain granites, and shales, weathered into infertile soils left uncultivated, though the patches of drift upon them were used for farmland. Equally, some of the bare limestone country of County Clare and County Galway is valueless for agriculture, but where these limestones have weathered into soil, a nutritive herbage develops which forms admirable pasture for sheep and cattle.

Study of drainage will provide one key to the qualities of Irish soils. Over most of the country, rainfalls are high (see below) and therefore soils retentive of moisture, such as clays, are frequently waterlogged, especially in low-lying areas. On a slope with good natural drainage, even a heavy clay soil will be suited to cultivation: in a depression, it may be a marsh, thickly covered with reeds and even wild iris but having a certain value as a pasture. Such soils are markedly acid, and therefore the fertilizers used include lime and various phosphates, partly in order to give some alkaline content. Lighter soils, such as sands, are less frequent in Ireland, though they include the famous Curragh area near Kildare, an open sheepwalk on glacial sands covering nine square miles. The eskers of the lowland normally consist of gravels and sands, generally of such low fertility that they are left uncultivated as lines of heath or woodland; but light soils are comparatively rare and the prevalence of clayey drift, containing some lime, may partly explain why so large an area of farmland is left as pasture.

Clearing of the lowland bogs of Ireland has been regarded for more than a century as one way of adding vast tracts of agricultural land for the use of the farming community. The lowland bogs vary in size from a few square yards to many square miles: the largest single expanse is the Bog of Allen, near Kildare and Edenderry. It is thought that lowland bogs develop on a fen in areas of impeded drainage, that after the Ice Age large areas between the drifts were covered with water, and that here, in time, marshy fens developed. Under the conditions of heavy rainfall, decaying vegetation was built up into a peat bog, spongy in texture, with acid water permeating the steadily increasing layers of vegetable matter. These conditions have prevailed from about 750 B.C. (the sub-Atlantic period), when the climate became moister than in the previous climatic phase (the sub-Boreal period, about 2500-750 B.C.): in this earlier period the fens developed and trees grew so plentifully that they are frequently seen when bogs are cleared. Ad-

vocates of bog clearing to provide new farmland on the underlying fen soils perhaps forget that under the present climatic conditions they would need a highly elaborate drainage to provide rich fields for crops, though cleared bogs are commonly used for potato growing and some good yields are obtained.

Climate.—What is generally called the "West Maritime" type of climate is excellently developed in Ireland. Lying to the west of Britain, it is traversed by numerous depressions from the Atlantic, all of a rain-bearing character. Cold anticyclones of continental origin in winter are less frequent than in Britain, and warm anticyclones of tropical origin are less marked in summer than in the south of England. As a whole, the climate may be described as "mild, moist, and changeable"; extreme cold, long frosts, heavy snows in winter and scorching days in summer are regarded as exceptions to the normal routine, in which one season grades imperceptibly into the next with rain as the only common element through the year. Late frosts and snows have been recorded in May, as in Britain; and every year contains some exceptional weather conditions.

Averages of temperature show a clear difference in winter between the west and east of Ireland. The mean monthly temperatures for winter in the west are 44°-45°F. (December to March), but slightly less in County Donegal, and in the east 41°-43°F. (November to March). The south coast is similar to the west, and the northwest to the east. On all the coasts, the temperatures are slightly higher than those inland at this season, and warm soft breezes, not infrequently accompanied by mist and rain, are characteristic. In summer, the isotherms show a steady decrease of temperature from south to north, from 60°-61°F. in Cork to 57°F. on the coasts of County Donegal. The evergreen quality of vegetation in the west is thought to be due to the lack of any marked check to plant growth through either cold or lack of rain; the arbutus, for example, a Mediterranean plant, is a low shrub in its own home but a tree in Ireland.

Rainfall in Ireland is, by general consent, excessive, and some four fifths of the country has 30-50 inches, whereas a similar proportion of England has 20-30 inches. Only some 500 square miles, in County Dublin and County Meath, has less than 30 inches, and in the mountains there are annual averages of 50-100 inches. Relief rain figures prominently in the west, and the highest falls, 90-100 inches, are recorded from Kerry, western Mayo, and western Galway (for example, Gap of Dunloe, Killarney, 94 inches). There are also heavy falls at some of the western lowland stations near the mountains, such as Garinish Island, Bantry, County Cork, 70 inches, and Kenmare, 65 inches. The number of rain days (that is, when more than 0.01 inch falls within 24 hours) is high everywhere, and varies from 175 in the extreme southeast to 200-250 on the west coast, and even more in the western mountains: at Cahersiveen, County Kerry, the rainfall of 56 inches falls on 252 days and in 834 hours, twice as many as in London. In the west, there is a marked winter maximum of rainfall; but in the east, a more even distribution. Dublin has its highest monthly fall in August, due to occasional thunderstorms or very heavy depression rains.

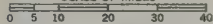
Westerly winds predominate in Ireland, though

IRELAND

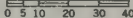
CONIC PROJECTION

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SCALE OF MILES



KILOMETRES



- Capitals
- Country Boundaries
- Canals
- Railroads



REPUBLIC OF IRELAND and NORTHERN IRELAND

REPUBLIC OF IRELAND

Total Population 2,818,341

CITIES and TOWNS

Abbeyleafe, 1,272	B	4	Poynes, 586	D	4
Aibheally, 1,085	D	4	Freshford, 656	D	4
Adare, 590	C	4	Galway, 22,028	B	3
An Uaimh (Navan), 3,998	E	3	Glenties, 828	C	2
Ardara, 547	C	2	Glin, 763	B	4
Ardee, 2,710	E	3	Gorey, 2,671	E	4
Arklow, 5,390	E	4	Grat, 1,044	C	3
Arthoy, 680	E	4	Gowran, 365	D	4
Athney, 1,236	C	3	Graigamagh	D	3
Athlone, 9,524	D	3	Granard, 1,047	E	4
Athy, 3,842	E	3	Greystones-Delgany, 3,551	F	3
Balbriggan, 2,943	E	3	Hacketstown, 509	E	4
Ballinagaderreen, 1,308	C	3	Headford, 567	B	4
Ballina, 6,027	B	2	Hollycross, '921	C	3
Ballinamore, 798	B	2	Hospital, 572	E	4
Ballinalasloe, 5,711	C	3	Howth, 5,614	E	4
Ballinrobe, 1,165	B	3	Inistioge, 233	C	2
Ballybay, 716	B	3	Inniscone, 533	C	2
Ballybofey, 1,030	D	2	Kanturk, 1,985	B	4
Ballyboyne, 1,163	B	3	Kells (Ceannanus Mor), 2,193	D	3
Ballyhaunis, 1,171	B	3	Kenmare, 1,046	B	4
Ballyjamesduff, 514	D	3	Kilbeggan, 799	E	3
Ballymahon, 830	D	3	Kilcock, 1,018	E	3
Ballymore Eustace, 348	E	3	Kilcoman, 1,018	D	3
Ballymote, 965	C	2	Kilcullen, 637	E	3
Ballyshannon, 2,322	C	2	Kildare, 2,551	E	3
Ballymore, 188	B	3	Kilglass, 295	B	4
Ballyglass, 866	D	3	Kilfinane, 565	C	2
Balsingher, 1,050	D	3	Kilkee, 1,382	E	4
Bandon, 2,308	C	5	Kilkeas, 1,083	E	4
Bantry, 2,234	B	5	Killala, 337	B	2
Belmullet, 724	A	2	Killalea, 835	C	4
Belurbet, 1,093	D	2	Killarney, 6,825	B	4
Birr, 3,221	D	3	Killenaule, 531	D	4
Birney, 595	E	3	Killeshandra, 397	D	2
Blesingford, 491	D	3	Killorglin, 1,100	B	4
Borrisokane, 750	C	3	Kilkeas, 1,083	E	4
Boyle, 1,739	C	3	Kilmalock, 1,159	C	4
Bray, 11,688	B	3	Kilrush, 2,861	B	4
Bruff, 545	C	4	Kiltimagh, 980	B	3
Buncrana, 2,960	D	1	Kingscourt, 793	E	3
Bundoran, 1,326	E	3	Kinsale, 1,587	C	5
Butterfield, 981	C	4	Kinvara, 538	E	3
Cahir, 1,652	D	4	Letterkenny, 4,329	D	2
Chahrivreen, 1,659	A	5	Lifford, 864	C	2
Callan, 1,346	B	4	Limerick, 50,786	C	4
Cappamore, 501	C	4	Lisdoonvarna, 625	B	3
Cappoquin, 806	D	4	Lismore, 810	B	4
Carlingford, 471	E	4	Listowel, 2,859	C	4
Carlow, 7,708	E	4	Longford, 3,558	D	3
Carndonagh, 1,016	D	1	Loughrea, 2,784	B	3
Carnew, 551	E	4	Louisburgh, 346	B	3
Carrick-on-Shannon, 1,497	D	3	Lusk, 495	E	3
Carrick-on-Suir, 4,672	D	4	Macroom, 2,169	C	3
Carrickmacross, 1,940	E	4	Malahide, 2,534	E	3
Castel, 2,498	B	3	Malow, 5,545	C	4
Castelbar, 5,482	B	3	Manorhamilton, 920	C	2
Castleblayney, 2,127	D	2	Maynooth, 1,773	C	5
Castletown-Donagule, 1,129	D	3	Midleton, 2,732	E	3
Castledermot, 551	E	3	Midford, 611	D	1
Castleisland, 1,718	B	4	Millstreet, 1,283	B	3
Castlepollard, 778	B	4	Milwott Malbay, 700	B	4
Castlerea, 1,583	C	3	Michelsown, 2,855	C	3
Castletownbere, 721	B	3	Moate, 1,251	C	2
Cavan, 3,208	D	3	Moilly, 916	D	3
Ceannanus Mor, 2,193	D	3	Monaghan, 4,013	D	2
Celbridge, 1,305	E	3	Moocoon, 507	D	4
Charleville (Rathluich), 1,956	C	4	Mount Bellew, 306	C	3
Charlra, 2,474	E	4	Mountmellick, 2,436	D	3
Claremorris, 1,519	B	3	Mountrath, 1,051	D	3
Clifden, 1,025	B	3	Moville, 1,097	D	3
Clogherhead, 585	E	3	Muinebeg, 2,071	E	4
Clonakilty, 2,417	B	3	Mullingar, 5,894	D	3
Clones, 2,107	B	3	Naas, 4,023	B	4
Clonmacnoise, *411	D	3	Navan (An Uaimh), 3,998	E	3
Clogmel, 1,640	D	3	Nenagh, 4,317	E	4</

Latest official figures. *District population.

Skibbereen, 2,028	B	5	Melvin (lake)	C	2
Sligo, 13,145	C	2	Mizen Head (prom.)	B	5
Snee, 282	A	5	Mizen Head (prom.)	F	4
Strokestown, 707	C	3	Monster (prom.), 848,368	B	4
Swinfino, 1,715	E	3	Nephin (mts.)	C	4
Swords, 1,816	E	3	Nore (river)	D	3
Taghmon, 347	E	4	North (sound)	B	4
Tallow, 1,191	C	4	Owell (lake)	D	3
Tarbert, 455	B	4	Ree (lake)	C	3
Templemore, 1,778	B	4	Royal (lake)	D	3
Thomastown, 1,209	D	4	Saint George's (channel)	F	4
Thurles, 6,421	D	4	Saltee (isls.)	E	4
Tipperary, 4,684	C	4	Scariff (isl.)	A	5
Trillick, 10,723	B	4	Seven Heads (prom.)	C	5
Tulmore, 1,882	D	4	Shannon (river)	C	4
Trim, 1,371	E	3	Shannon Airport	C	4
Tuam, 3,500	C	3	Sheep Haven (harb.)	C	1
Tubbercurry, 878	C	2	Shenhy (mts.)	B	5
Tulla, 389	C	2	Slieve (river)	E	4
Tullaghan, 2,343	C	2	Slea Head (prom.)	C	4
Tullow, 1,725	E	4	Sieve Bloom (mts.)	C	2
Ullingsford, 562	D	4	Sieve Gampth (mts.)	D	3
Waterford, 28,132	D	4	Syne Head (isl.)	A	3
Westport, 2,882	B	3	Suck (river)	C	3
Westport, 11,528	C	3	Suir (river)	C	3
Wicklow, 3,125	F	4	Swilly (inlet)	D	1
Youghal, 5,043	C	5	Tara (hill)	E	3

PHYSICAL FEATURES

Achill (isl.), 4,220	A 3	Ulster (prov.), 217,489	C 2
Achill Head (prom.)	A 3	Valentia (isl.)	A 5

NORTHERN IRELAND

Total Population 1,425,462

CITIES and TOWNS

Antrim, 1,448	E
Armagh, 9,982	E
Ashleynacloy, 805	D
Ballyacally, 2,293	F
Ballycallyre, 4,441	E
Ballymena, 17,740	E
Ballymoney, 3,409	F
Ballynahinch, 2,038	E
Bransbridge, 6,115	E
Bangor, 23,865	F
Bangor (cap.), 416,094	F
Belmont, 1,622	E
Belfast, 162	D
Bessbrook, 3,084	E
Bushmills, 935	E
Carrickfergus, 10,211	F
Castlederg, 890	D
Coalisland, 1,356	E
Colemance, 11,512	E
Comber, 3,987	F
Cookstown, 4,964	E
Downpatrick, 4,219	F
Drumore, 2,125	E
Dungannon, 6,494	D
Enniskillen, 7,438	D
Enniskerry, 1,266	F
Finnarum, 581	D
Finstown, 934	E
Keady, 1,638	E
Killyleagh, 1,876	F
Kilrea, 944	E
Larne, 16,341	F
Lisnady, 4,324	E
Lisburn, 17,691	F
Lisnasry, 971	E
Lisnavea, 1,622	F
Londonderry, 53,744	D
Lurgan, 17,873	E
Maghera, 1,613	E
Magherafelt, 2,460	E
Markethill, 813	E
Moneymore, 807	E
Newcastle, 3,722	E
Newry, 12,450	E
Newtownards, 13,090	F
Newtownstewart, 1,265	D
Omagh, 8,109	E
Portadown, 18,605	E
Porrush, 4,263	E
Powestown, 3,950	E
Ston Mills, 1,623	D
Strabane, 7,796	D
Warrenpoint, 3,238	E
Whitehead, 2,174	F

PHYSICAL FEATURES

Bann (river)	E
Blackwater (river)	E
Dundrum (bay)	F
Foyle (river)	F
Garron (point)	D
Giant's Causeway (prom.)	E
Lagan (river)	E
Magee (isl.)	F
Main (river)	E
Mourne (mts.)	E
Neagh (lake)	E
North (channel)	E
Rathlin (isl.)	E
Red (bay)	F
Slieve Donard (mt.)	F
Spermin (mts.)	D
Strangford (inlet)	F
Upper Erne (lake)	D

IRELAND



Along the road skirting one of the beautiful lakes of Killarney.



O'Connell Bridge, Dublin.

© Gendreau

IRELAND



The famous, timeworn Cross of Cashel (8th century),
County Tipperary.



The Round Tower on the rock of Cashel, near Tipperary.



The ruins of Ross Castle, Kerry County.

naturally a country subject to so many depressions has winds from all quarters: but at most stations for which detailed records exist, nearly two thirds of the winds come from some direction between south and northwest. Winds of gale force average 40 a year on the west coast, and several winds of more than 90 miles per hour have been recorded. On Jan. 30, 1925, a train was blown off a viaduct in County Donegal and most of the passengers killed or injured. The light railways take special precautions against gales; for example, the West Clare Railway authorities ballast the carriages with concrete when the winds reach 60 miles per hour, and traffic ceases when the winds reach 80 miles per hour.

The climate has a direct effect on the vegetation, described below. It cannot be too strongly stressed that the figures used in this section are averages and that the weather varies considerably from one season to another. For Queen's University, Belfast, figures for 79 years (1861-1939) are available: the average rainfall was 34.9 inches, but this occurred in only two years, though most years had within 15 per cent of the average. A few, however, had as much as 25 per cent more or less than the average, and it seems that a period of dry years is followed by a period of wet years.

Flora and Fauna.—Ireland is poorer in flora than Britain: it is estimated to have only two thirds as many species of plants as its neighbor, due to the fact that Ireland was separated from Britain before Britain was separated from continental Europe. Much of the Irish flora must have survived the Ice Age either on the ice-free strips within the country or on unglaciated areas now submerged. There are some species of American origin, which are presumed to have reached Ireland and Greenland, and others are of Mediterranean origin: these are found largely but not exclusively, on the west coasts, in some places intermingled with one another and in others among plants of European origin.

The American species include an orchid (*Spiranthes stricta*), found in damp meadows and in the Bann Valley, and a rush (*Juncus macer*) which has been discovered in County Wicklow and also in the extreme southwest. None of the American species is conspicuous, and more interest lies in the consideration of Mediterranean plants, which include the arbutus (see above) growing into a tree, various ericas (heaths), and various saxifrages. The wealth and variety of saxifrages in the west of Ireland has attracted many botanists: one, *Saxifraga spathularis*, which grows in Portugal, northern Spain, and the Pyrenees, is luxuriantly developed in mountain areas of Kerry, Cork, Galway, and Mayo. Alpine plants have a poor range of species, and although the mountains have wide heathery moorlands, there is no continuous area of land at a sufficient altitude to possess an arctic-alpine vegetation similar to that of the English Lake District, Snowdonia (North Wales), or the Scottish Highlands. Alpines are more frequent in the north than the south, though in Ireland, as in the west of Scotland, they occur at all altitudes down to sea level. In all probability, the remarkable spread of alpine plants in the west is due to indirect climatic influence: the restriction of tree growth by seawinds has left land available for other plants. Consequently, there are some strange mixtures of plants in the west, notably in the Burren of County Clare, which has the alpine species *Dryas octo-*

petala and *Gentiana verna* mingled with the Mediterranean maidenhair fern (*Adiantum capillus-veneris*): the latter is found in sheltered hollows and cracks in the limestone pavement. The restriction of vegetation to ground species characteristic of the west coast is a feature shared by the similar coasts of Scotland and Norway.

Only a short distance from the coast, in sheltered places, luxuriant tree growth is seen, notably in the Killarney Valley, which has rich woods in which trees are covered with ferns and mosses, and the ground flora forms a dense mat of vegetation. In exposed places the phenomenon of wind-shearing is seen: a grove of trees will have low growth on the west and higher growth on the east, and single trees will have their buds killed on the west side. In these circumstances, it is difficult to establish a treeline in terms of altitude, for on the west coast the treeline is at sea level, at 600-800 feet in Kerry, and in the east, for example in the Wicklow Mountains, it is at 1,200 feet or more, in some sheltered valleys.

At the present time, Ireland has a mere 2½ per cent of its area in woodland, less than any other European country except Iceland, but before the woods were cleared for agricultural expansion and other purposes, a large part of the land was covered with forest, though the bogs are naturally treeless. Nevertheless, Ireland has a wooded appearance, as numerous single trees are planted in hedgerows or as small sheltering woods near farmlands. The oak is the dominant tree in most woods, along with birch, or ash (this especially on limestone soils), hazel, rowan, and many more: in damp places, alders and willows are found. Hazel scrub is developed in profusion on the limestones near Galway Bay, away from the west coast. There are only two native conifers, the juniper and the yew, but various pines and larches have seeded themselves plentifully and even invaded some of the country's oakwoods and birchwoods: other introduced trees, such as the sycamore, have also spread by seeding, and in the rich moist woods of the Killarney area rhododendrons have run wild. Even the exotic bamboo will grow luxuriantly in sheltered places in the south of Ireland: the National Botanic Gardens at Glasnevin, Dublin, have a remarkable collection of trees drawn from various parts of the world.

The fauna, like the flora, has fewer species than Britain, but it includes some species with a likeness to those of Scandinavian and Arctic regions, and others with Mediterranean affinities. Of the mammals, the fox, the badger, the otter, the stoat are all abundant, but the weasel and the polecat do not exist. Wolves were exterminated by the 18th century. Hedgehogs abound, but there are no moles, and Irish visitors to Britain are puzzled by the molehills of many pastures. There are fewer types of bats in Ireland. The Irish hare is the varying hare of the Scottish highlands and various alpine and northern regions of continental Europe, but it does not normally change its coat to whiteness in winter in Ireland.

Of the birds, there are fewer species, but many sea birds exist in vast numbers on the cliffs, especially on the west coast; these include gulls and dippers. Certain birds of prey, such as the peregrine falcon, nest on seacliffs and mountains throughout the country, and the golden eagle nests in the remoter parts of Mayo and Donegal. But a number of familiar English birds, such as the nightingale, the reed warbler,

and the tawny owl, are quite unknown in Ireland: the magpie, said to have arrived in a small flock in 1684, has spread widely through the country.

The brown lizard is the only native reptile, and the absence of snakes (said by legend to have been banished by St. Patrick) is well known. The common frog is abundant, but only a single species of the three British newts is found. Some of the invertebrates show Mediterranean affinities, notably a spotted slug found in western Kerry and western Cork. A snail, *Helix pisana*, is found in the east and in Britain only in south Wales and Cornwall; it also occurs in southern France and along the Mediterranean shores. Researches on the fauna raise the same fascinating problems of origin that are raised in considering the flora: clearly there is a complex relationship between the two.

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HISTORY TO 1601 A.D.

Irish literature contains stories of the occupation of the island by various peoples—Nemedians, Fomorians, Fírbolgs, Tuatha De Danann, Milesians—in succession. The last-named people, called in Irish the *Clanna Míled*, has been identified generally in modern times with the Celts, who brought to Ireland a Celtic language or languages and Celtic civilization about the middle of the first millennium B.C. Ireland marked the western limit to a great movement of expansion which carried the Celts from a homeland somewhere in central Europe to Asia Minor, Spain, the Low Countries, France, and England. Beyond Galway lay the Atlantic breakers and the boundless waste of ocean on which frail barques ventured at their peril.

A glimpse of Ireland at the dawn of history is afforded by tales of the Cú Chulainn or Ulster literary cycle. The personages whose doings this cycle records would have lived about the beginning of the Christian era. By that time the island had been parceled out among five major kings, a division that was to last until the Middle Ages, when Meath would lose its ancient status and Ulster, Leinster, Munster, and Connacht become the four Irish provinces. The Finn cycle of Irish literature, which belongs perhaps to the 3d century A.D., shows no appreciable change in the Irish political situation, though it does indicate changes in civilization. Struggles for power between the five kings led to the predominance of the Meath dynasty in the northern half of Ireland (Leth Cuinn) and to the predominance of the Munster dynasty in the southern half of Ireland (Leth Moga). Finally, at a date before 400 A.D., the Meath dynasts established their claim to suzerainty over the whole of Ireland and to the

corresponding title *Ri Erend* (King of Ireland). Their chief fortress was on the hill of Tara, which thus became fixed in tradition as the capital, the home of the high-king, the symbol of national unity, the focus of national aspirations.

The first high-king of whom the historian can speak with certainty is Niall of the Nine Hostages, undoubtedly one of the greatest Irishmen who ever lived. Three of his sons won for themselves a new kingdom in northwestern Ulster; other sons were settled in strong positions in the large midland region between the Shannon and the Irish Sea. Two of his brothers were successively kings of Connacht. His son, Loeguire, was high-king when St. Patrick came as a missionary to Ireland (the traditional date is 432 A.D.). Niall's direct descendants, the Ui Neill, held the kingship of Ireland without a break from 482 to 1002. From 732 onwards this highest honor in the land went alternately to the Ui Neill of Ulster and the Ui Neill of the midlands. From Niall, too, descended the best-beloved of native Irish saints, Columba of Iona, or Colmcille, the princely families of O'Neill, O'Donnell, MacLoughlin, O Maelsechlainn, and a host of lesser families who form no small part of the population of Ireland in modern times.

Within a short time after the introduction of Christianity Ireland enjoyed a period of bloom in the realms of religion, learning, and art, to such an extent that the country could be called "The Island of Saints and Scholars." In the political order there was no comparable advance. From the beginning of the 6th century to the beginning of the 9th century society remained essentially unchanged. Individual liberty was highly prized; so also, the liberty of the family within the local state; the liberty of the small rural state within the small local kingdom; the liberty of the small local kingdom within the five larger kingdoms; the liberty of these (Ulster, Meath, Leinster, Munster, Connacht) in their relations with the king of Ireland. Though the high-king's prestige was immense, his political power outside his own patrimony was generally restricted: it depended much on personal distinction and, in the ultimate analysis, on the size of his army and the capacity which he showed when he led it into the field.

Norse Invaders.—In 795 Ireland was attacked for the first time by a dangerous foreign enemy. He came from the pagan and barbarian north (chiefly, it would seem, from Norway rather than from Denmark or Sweden) and continued his depredations for more than two centuries. This is the Norse Era in Irish history (795–1014). In the art of seamanship the Northmen then had no equals in Europe, outside of Byzantium, and they used their one accomplishment to win riches and power at the expense of other peoples. From 795 to 837 Ireland was thrown into turmoil by their raids. They came in fleets, sometimes large, sometimes small, landed suddenly in a bay or creek, despoiled the countryside (especially the peaceful monastic settlements), and returned with booty to the safety of their ships before the local state could gather its army in self-defense. In 837 they took permanent possession of a strip of land near the Liffey mouth. This is the origin of the town and later city of Dublin. Now and afterwards the Irish kings showed more eagerness to use the Norse as foils in the game of politics than to drive them once for all from the country. An unfortunate cam-

paign, in which Munster was defeated by the high-king and grievously weakened led to the foundation of the two Norse towns, Waterford and Limerick, in the south of Ireland about 920. The presence of the Northmen at Limerick led to a fierce local reaction. Surrounding the new settlers was a little state called Dal Chais. The energetic dynasts of this people waged relentless war on the intruders, building up in the process an army which in time became strong enough not merely to subdue the foreigners but to secure for its commander the kingship of Munster. Brian Boramha (Brian; Brian Boru), second Munster king of the Dalcassian line, deposed the Uí Neill monarch, Malachy II, in 1002, and took his place as king of Ireland. In a famous battle fought at Clontarf, near Dublin, in 1014, Brian was opposed not only by Irish malcontents but by the Norse of Dublin assisted by a formidable force of Norse auxiliaries from abroad. Brian's victory, won at the cost of his own life, broke forever the power of the Northmen in Ireland. In the next generation they accepted the Christian faith, after which they lived on in their own towns, under the immediate rule of their own leaders but subject to Irish kings.

Political Ferment.—An unhappy consequence of Brian Boramha's intrusion into the high-kingship was confusion at his death. On the one hand his son and successor in Munster was unable to take his brilliant father's place as king of Ireland; on the other hand, the tradition of Uí Neill succession was shattered beyond repair. Thus it happened that for half a century (1022–1072) the throne of Ireland remained empty. The principle was maintained that supreme political authority in the country should be represented by a high-king, but there was no ruler strong enough to merit recognition as such. Strife increased, not only between state and state, but also within various states and even within dynasties, a development whose deepest roots lay in the Irish system of succession to kingship. When a vacancy occurred it was filled by election. The prince chosen was one of a group, all of whom had rights that were theoretically equal. Disappointed candidates were all too prone to remain in a state of permanent conspiracy against the more fortunate rival who had been elected. This weakness in the Irish constitution had inevitably been intensified by the disintegration due to the Norse invasions.

Donnchad, son of Brian Boramha, was the chief ruler in the Ireland of his day, but his power was meager outside of Munster. Deposed by his nephew Toirdelbach in 1064, he journeyed as a pilgrim to Rome; and at his death he was buried there in the church of San Stefano Rotondo. By 1072 the prestige of Toirdelbach O'Brien had increased to the point when he could lay claim to the kingship of Ireland, but that goal was never reached during the 14 years of life that remained to him.

A greater man than Toirdelbach was his son, King Muirchertach O'Brien. He was an enthusiastic supporter of the movement for reform inaugurated by Pope Gregory VII. One of his daughters married a son of King Magnus of Norway; another daughter traveled to England to become the wife of a powerful Norman lord. Muirchertach exchanged letters with St. Anselm of Canterbury, who addressed him as "glorious King of Ireland." The title, however, was never quite justified by Muirchertach's achievement, for

away in the north, near Derry, sat a king, Domnall Mac Lochlainn, whose opposition he was unable to overcome.

Muirchertach O'Brien died in 1119, leaving his inheritance to nephews of lesser caliber. Mac Lochlainn died soon afterwards, and the chief place on the stage of Irish politics passed to the king of Connacht, Toirdelbach O'Connor. He used naval power with some effect in the Shannon River and along the Atlantic seaboard. He also built bridges at strategic points and erected fortresses of the new type, called castles, which the Norman conquerors had multiplied in England. O'Connor's success was for a time remarkable, but the promise of his early years was not fulfilled, and long before his death in 1153 his failure to reduce the other Irish states to submission was painfully evident. His successor as chief claimant to the kingship of Ireland was Muirchertach Mac Lochlainn, grandson of the Domnall mentioned above. By 1161 his ambition seemed to be realized but fortune soon deserted him, and in 1166 he lost both throne and life. The way was then open for Ruaidrí O'Connor, son of Toirdelbach, to win recognition as king of Ireland. In that capacity he presided over the great national assembly at Tailtiu in Meath in 1168. The days of struggle for the high-kingship seemed to be over and the throne of Ireland firmly in the keeping of the royal house of Connacht.

Anglo-Norman Penetration.—Peace, however, was a gift which the people of Ireland were not destined to enjoy. O'Connor, in the first major action of his rule as high-king, expelled Diarmaid Mac Murchadha from the kingship of Leinster. The deposed ruler crossed the Irish Sea and sought help from Henry II of England. Henry had already contemplated the conquest of Ireland, for we have it on the word of John of Salisbury that in 1154 he had sought sanction for the step from the English-born Pope Adrian IV. Thus the appeal of Mac Murchadha provided a happy excuse for the furtherance of his policy. The English king espoused enthusiastically the exile's cause. Small contingents of Norman knights were sent to Ireland with Mac Murchadha, but were easily defeated by the high-king. Then, in August 1170, came an army of picked men under a redoubtable leader, Richard de Clare, 2d earl of Pembroke, better known as Strongbow. O'Connor and his troops found themselves confronted by a situation with which they were unable to cope: the Norman knights were clad in armor from head to foot; they carried long lances and fought from horseback; and they were assisted by archers armed with longbow and crossbow. Moreover, they had the rigid discipline of professional soldiers, and they were skilled in erecting fortifications which the Irish lacked instruments to reduce. In a word, the Normans were incomparably superior to the Irish of the day in military organization.

The inevitable result followed. Waterford fell, and also Dublin. When Mac Murchadha died, Strongbow, who had married his daughter, claimed the succession to Leinster. O'Connor besieged Dublin, but without success. Henry II himself arrived in Ireland in October 1171, and stayed until Easter 1172. O'Connor and the Irish princes submitted to the Norman king on the understanding that this would save them from the depredations of the barons. But in this they were mistaken; large areas of Irish land

were parceled out to the nominees of the crown. After three years of warfare a treaty was signed at Windsor between O'Connor and Henry II, but its terms were violated by Henry and the Norman lords, and the struggle continued.

For over a century the tide of fortune favored the Norman invaders, who carved out for themselves principalities in all parts of Ireland. Henry II sent his son, Prince John, to govern the conquered island in 1185. When John became king of England he built a strong castle at Dublin and arranged to have the country administered by a central government. An attempt was made to fill the bishoprics and higher offices of the Church with Anglo-Norman prelates. The 13th century saw not only the conquest of Coniacht but the rise to eminence of the two great Fitzgerald families of Kildare and Desmond and the families of De Burgh (Burke) and Butler.

By 1300 Norman power had passed its peak and an Irish recovery had begun. After the victory of Bannockburn (June 1314), Robert Bruce got in touch with the Irish princes and encouraged their efforts to form a national league. His brother, Edward Bruce, was crowned king of Ireland on May Day, 1316, but in a battle near Dundalk (October 1318), Bruce was killed and the Norman colony saved. During the long campaign English organization weakened and the Irish began to advance steadily in every portion of the island.

Assimilation of the Normans.—Remarkable in the 14th century is the extent to which the Normans became assimilated. In the case of the great lords the change was partial, for though they adopted Irish civilization, they did not renounce their allegiance to the English crown. By 1366 the colony had become so "degenerate" that Lionel, son of Edward III, was sent from England to provide a remedy. The "Statutes of Kilkenny" which he promulgated sought to preserve the English way of life in that part of Ireland which the colonists still controlled. The Statutes were a dead letter, and before the century ended the government in Dublin was compelled to pay "black rent" to Mac Murchadha of Leinster to restrain him from attacking the capital. Visits of Richard II in 1394 and again in 1399 ended in utter failure.

In the 15th century the picture remains essentially the same. During this period the Fitzgeralds in Desmond and Kildare reached the zenith of their power. Gerald, the "Great Earl" of Kildare (1477-1513), held the office of deputy (viceroys) for 30 years and ruled Ireland like a king. But the old order was changing with the accession to the throne of England of highly autocratic Tudor sovereigns.

Tudor Period.—Gerald, son of "the Great Earl," and himself 9th earl of Kildare, was appointed lord deputy by Henry VIII. Wolsey, however, hated the Fitzgeralds and was resolved to bring about their downfall. Kildare survived unscathed until 1533. Summoned to London then to answer charges, he named his son, "Silken Thomas," deputy in his stead. A report soon reached Ireland that the earl had been executed. Thomas immediately rebelled. In the campaign which followed he was defeated and forced to surrender; and he and his five uncles were beheaded in the Tower of London in 1537. With them the house of Kildare, as an independent force in Irish politics, came to an end.

The break of Henry VIII with Pope Clement VII had of necessity repercussions in Ireland. Henry had carried through the Irish Parliament acts that gave him complete control of ecclesiastical affairs. All monasteries were suppressed, save such as for the moment lay outside the reach of Henry's arm. Tudor power in the political field was now overwhelming, and the Irish princes tried to counteract it by securing aid from Henry II of France, but the negotiations came to nothing.

Queen Mary Tudor initiated the policy of expelling native Irish from their holdings and introducing in their stead planters from England. The idea appealed also to her successor, Elizabeth, and was applied by her with effect in Munster towards the end of her reign, when a favorable opportunity offered.

Elizabeth's policy in Ireland, like that of Henry VIII, was based on two main principles: complete control of the whole country by means of government officials operating from Dublin, and complete uniformity in religion. This meant constant warfare, since the Irish were prepared to fight to the death for their freedom and for their Catholic faith. In Ulster, where the old Irish population had been least disturbed, the opposition was strongest. Shane O'Neill ruled the northern province for years like a king. When not at peace with Elizabeth and her deputies he fought them with considerable success. His own overbearing rule was, however, resented by Ulster chiefs and in a quarrel with the MacDonnells of Antrim he was slain in 1567.

Soon afterwards a confederacy of Irishmen was formed under the leadership of the Desmond nobleman, James Fitzmaurice Fitzgerald. The Irish princes and lords, hamstrung in their effort to make war by the lack of guns and ammunition, appealed to Philip II of Spain for help. Philip dallied, as always. The religious issue was now uppermost and the papal court, no less than the court of the Spanish king, was interested in the result. Small expeditions were fitted out and sent to Ireland, but they were annihilated by the English commanders. Sir James was killed (1579). Gerald Fitzgerald, the 15th earl of Desmond, lacked energy and ability as a leader. So the movement collapsed; Desmond was beheaded (1583) and his great estates in Munster divided into plots and disposed of to English planters.

Within a few years, however, resistance was renewed on a national scale. The leaders were Hugh O'Neill, earl of Tyrone (since 1585) and Hugh O'Donnell of Tyrconnell or Donegal. O'Neill had been taken to England as a boy and educated in English ways. O'Donnell had twice been captured and twice escaped from Dublin Castle; with his second and successful bid for freedom, on Christmas Eve 1591, the Nine Years' War may be said to begin.

Nine Years' War.—Not only did all attacks on the north by English armies fail, but in 1598 O'Neill won an important victory over the English commander, Marshal Bagenal, at the Yellow Ford, near Armagh. The result was a great increase of enthusiasm and a gathering of forces from all Ireland under O'Neill's standard. Elizabeth was alarmed. A new army of immense size was collected and sent to Ireland under the command of Robert Devereux, 2d earl of Essex, but it achieved nothing and the campaign ended in a truce and the drafting by O'Neill of conditions under which he was willing to make

peace. These were rejected by Elizabeth; and Essex, after a foolish revolt, lost his head. His place was taken by Lord Mountjoy, who adopted the ruthless policy of burning all crops and all food and so reducing the people to submission by famine rather than by arms. O'Neill had appealed to Spain for help, above all for artillery, without which his army could not maintain itself in the field. Philip III at last (September 1601) sent a small contingent of men and arms, but it landed at Kinsale in the south, where it could give only the minimum of assistance to O'Neill. Soon the Spaniards were shut in by the English fleet at the harbor mouth and by Mountjoy's army on the land side round the walls. O'Neill and O'Donnell marched from the north to the Spaniards' relief. It was decided, against O'Neill's better judgment, to undertake a general assault on the English lines. This took place on Dec. 23, 1601, and completely miscarried. The Battle of Kinsale proved to be a defeat from which O'Neill and O'Donnell were unable to recover. They were compelled to sue for peace and to accept the conditions which the English were willing to offer.

JOHN RYAN, S. J.

HISTORY FROM 1601 TO 1800

The Battle of Kinsale proved to be decisive: the prospect of an independent Irish nation, based on the old Gaelic order, was quickly to disappear. Hugh O'Neill held out in Ulster until 1603, when he made his submission to the lord deputy, Mountjoy, only to find that Queen Elizabeth had died a week before. With the new king, James I, O'Neill had been on friendly terms: had he delayed his submission, he might at least have been spared some indignities. Mountjoy, however, was not vindictive, and with James disposed to leniency the reign opened promisingly enough for Ireland. The promise was not maintained. Alarmed by the Gunpowder Plot (q.v.) and unable to stem the anti-popery tide in England, James had little power, even had he the will, to prevent measures against the Irish Catholics. Those measures soon extended beyond the enactment of laws enjoining conformity with the Established Church. Under the lord deputyship of Sir Arthur Chichester (1604-1614) the ground was prepared for the Penal Laws under which Irish Catholics were to labor for more than two centuries. Catholics were *ipso facto* suspected rebels; and from this uncongenial atmosphere O'Neill, O'Donnell, and others of the "Old Irish" decided to take refuge in exile. "The Flight of the Earls" in 1607 symbolized the collapse of the Old Irish society; and it was made the excuse for the most comprehensive confiscation and resettlement of land that had yet been effected. Half a million acres in Ulster were distributed to settlers from across the channel, mainly Presbyterians from the Scottish Lowlands. The natives, though not expelled outright, found themselves left in possession only of land that was too poor in quality to be an attraction to the newcomers.

To confirm all the measures taken in the early part of his reign, James called a parliament in Dublin in 1613. With some skill, this assembly was "packed" to ensure a Protestant majority. The loyalty of the minority of Catholic representatives was not in question, but it was determined that they should have no opportunity to make use of the occasion to attack

the Penal Laws. They were nevertheless strong enough, if not to secure a much greater degree of toleration, at least to ensure that no further steps were taken against them, and in 1615, James, finding that little was to be obtained from the parliament, ordered its dissolution.

In the last years of James's reign Ireland was tranquil, and comparatively prosperous; and the accession of Charles I, who had married a Catholic and was himself "High Church," gave promise of still brighter days to come. Charles, however, regarded Ireland throughout his reign primarily as a potential source of revenue, to be obtained if necessary by double-dealing. Concessions to the Catholics were offered for cash; the money was paid over, but the Graces (as these concessions were termed) were never given statutory effect. No real departure, in fact, was made from the Irish policy of James until, in 1632, Thomas Wentworth arrived as lord deputy, determined to make Ireland a source both of wealth and of strength to the crown. Roman Catholic and Protestant were played off, one against the other, to keep them occupied while Wentworth strove to restore the royal prerogatives and powers—and the revenues attached to them—that had fallen into the hands of local magnates. Many of his reforms were salutary, but they brought him the undying hatred of the monopolists—men such as Richard Boyle, earl of Cork who as a young man had arrived in Ireland a penniless adventurer and risen to be the greatest power in the land. Wentworth, made earl of Strafford in 1640, had been recalled in 1639 to deal with Charles's increasing difficulties at home; and it was largely the evidence of the men he had angered in Ireland that helped, two years later, to bring him to the block.

Insurrection.—In the meantime, the government of Ireland had fallen into the hands of supporters of the Puritan Parliament of England, whose actions helped to precipitate a rebellion in 1641 in which the natives rose and massacred the Ulster settlers. The insurrection was an outburst against repression, rather than a calculated nationalist uprising; and the issues were confused by the fact that Charles, who originally attempted to put down the rebels, was soon in need of their assistance against his Parliamentary foes. The Irish Catholics formed a confederacy, calling back from the continent the exiles Owen Roe O'Neill and Gen. Thomas Preston to lead their forces. Owen, a nephew of Hugh O'Neill, was the natural leader of the Old Irish stock; Preston, of the Catholic Old English. In addition there was the Anglican James Butler, marquiss of Ormonde, Charles's lord lieutenant in Ireland, at the head of the Royalist forces. Ormonde, at first ordered to put down the rebels, was soon required by Charles to come to terms with them, to secure their help against the Parliamentary forces. Between these groups divisions were inevitable, serious enough to enable the Parliamentary forces, numerically far weaker, to survive. Not even Owen Roe's resounding victory at Benburb in 1646 succeeded in dislodging them, and antagonism between the Royalists and the Catholics paved the way both for Charles's final defeat and for Oliver Cromwell's subjugation of Ireland. Cromwell arrived in Ireland in 1649, promptly avenging the deaths of the Ulster settlers in his massacres of the inhabitants of Drogheda and Wexford. The combination of terrorism and military skill led to the

collapse of the rebellion, though it was not finally stamped out until 1652.

Cromwellian Regime.—"Cromwell's Curse" was not to be forgotten or forgiven in Ireland. Not only were the Irish defeated in the field; all their estates east of the Shannon were forfeited. Over half of the land to the east of the river was confiscated and redistributed in a resettlement by contrast with which the Plantation of Ulster 40 years earlier was unsystematic and naïve. Some 30,000 Irish soldiers were allowed to go into exile in the service of continental powers, and thousands of commoners were sent to virtual slavery in the West Indies. The power of the Old English in Ireland went the way of the power of the Old Irish: henceforth for generations the new English element dominated the country's life. A union with Britain was enacted in 1653, providing for Irish representation in the English Parliament; and only the short duration of Cromwellian rule prevented Ireland from effective anglicization.

The Restoration in 1660 did not entirely redress the balance, as Charles II was unwilling to risk unpopularity by concessions to the Irish Catholics. The Irish Parliament was restored, but Catholics were no longer allowed to take seats in it. Although some of the Catholic lands were regained by their former owners, the Protestant "ascendancy" remained firmly established, and such toleration as the Catholics were able to obtain in practice was only on sufferance. The Anglican Church alone was officially recognized. Again, a period of peace under the able rule of Ormonde, who was lord lieutenant for the greater part of the reign, brought a revival in prosperity; and at Charles II's death in 1685 the country was in a fair way to recovery from the chaos of the 1640's. But the brief rule of his successor, James II, brought with it disaster. The appointment of a Catholic, Richard Talbot, earl of Tyrconnell, as commander in chief and then as lord deputy, led to a revival of the hopes that had given rise to the Catholic Confederacy. Some political power was restored to Catholic hands, and when William of Orange drove James from England in 1688, the Irish gave James their loyalty as the legitimate king. James had no sympathy with Irish national aspirations, but he saw in these loyal subjects a weapon which he could use to procure his restoration. Louis XIV of France thought to use the Irish in pursuance of his wider aims, and in 1689 he dispatched James in a French fleet to Kinsale. Once again, the divided and sometimes conflicting motives of the Irish helped to paralyze their effort. The greater experience and skill of William's forces led to the crushing defeat of the Irish at the Battle of the Boyne in 1690, and the following year, the last of their commanders, Patrick Sarsfield, surrendered at Limerick and was allowed to depart with most of his men to fight for France, as the "Wild Geese," on continental fields.

Penal Laws Maintained.—If the settlement made by William III was less repressive than Cromwell's, the reason was that there was not so much to repress. In the event, however, the new reign bore more heavily on the Irish because the Penal Laws were not relaxed, as they had been on similar occasions under the Stuarts, as soon as a state of emergency no longer existed. The Penal Laws remained, and were actually intensified, although this was a flagrant breach of

the treaty made at Limerick. Under them, the Catholics sank into the condition of helots. Legally designated "Papists," they found the doors to the acquisition of land, to education, and to administrative posts closed to them. Their decline was facilitated by the introduction of the potato, which provided a food upon which peasant families could live on the minimum of land, assisting the Catholic peasantry to sink into a squalor and misery as abject as was to be found anywhere in Europe.

The Protestant "ascendancy," however, soon found themselves unable to profit from the subjection of their fellow countrymen. Even if the Irish Parliament had not been in effect manipulated by the English executive, it was in any case severely restricted in its competence. Ireland was to all intents subject to British rule. In commerce, this was particularly galling. The industry of the country was virtually annihilated by English legislation at the behest of English traders, jealous of potential rivals; and only linen, among Irish manufactures, continued to enjoy prosperity.

Under Queen Anne the Penal Laws became yet more rigorous; for example, a gavelkind (land tenure) act was passed ruling that land owned by Catholics must be divided up amongst all the owners' heirs, unless the eldest should become a convert to the Established Church, in which case all the property would be his. The Irish had not brought this further burden upon themselves, crushed and dispirited as they were. It was their misfortune that the Stuart pretenders to the British throne continued to act as a threat to the safety of the House of Orange, and then of the Hanoverian dynasty, giving repression its justification.

The first half of the 18th century would be black indeed, were it not illumined for a brief spell by the genius of Jonathan Swift. He appeared on the scene at a time when his country's commerce was nearly extinguished, its religion vindictively penalized, and its government in alien hands. The viceroys rarely felt it necessary even to visit the country under their charge, and the land was ruled by lords justices, who transacted such routine business as was required with the help of a Parliament well "packed" with placemen—the "undertakers," as they came to be called. Most of the lucrative posts went to Englishmen. In 1719 the Declaratory Act finally removed what little substance of Irish legislative independence remained, affirming the right of the English Parliament to bind Ireland in its acts; and only the shadow—the corrupt Irish Parliament—remained. So confident were the English of their strength in Ireland that a project put forward in 1722 that would have led to a debasement of the Irish coinage for the profit of William Wood, a protégé of one of George I's former mistresses, was casually accepted. In his *Drapier's Letters*, Dean Swift, a Protestant, unleashed all the resources of his devastating invective against "Wood's halfpence." The effect was electrifying. For the first time, the Protestants were united for the Irish cause in a national issue. They roused themselves to such good purpose that the coins never made their appearance, and the English had hastily to dispatch a viceroy of some ability, Lord Carteret, to the scene.

Now that there was so little to fear from the Catholics, crushed as they were beneath the

Penal Laws, Irish Protestant nationalism began sporadically to assert itself against the irritations and humiliations of alien rule. Thus it came about that, although the Stuart rising of 1745 had little impact upon Ireland, before the turn of the half century Charles Lucas, by his political pamphlets, had gone some way towards reviving the popular feeling that *Drapier's Letters* had aroused in Dublin. A section of the Irish Parliament, too, was bestirring itself to make a demand for greater control of the national finances, and in 1753 the Commons actually threw out a money bill that had been sent over from England. Pensions and titles were hurriedly distributed to win over the dissidents. For a few years an uneasy quiet was restored; but during the viceroyalty of Lord Townshend the system of government by "undertakers" received further shocks. Townshend arrived in 1767; the following year an act was passed limiting the duration of parliaments to eight years, and in 1769 the Commons again rejected an English money bill.

Patriot Movement.—This time the attempt to bring the Irish Parliament under control was less successful. A new generation of Irish Protestants was springing up, including such men as Henry Grattan and Henry Flood, who had strong links with the Whig reformers in Britain. A Patriot Party began to grow, demanding an Irish Parliament emptied of "undertakers," with power to control the country's finance and commerce. The American War of Independence came fortuitously to their assistance. Anxious for Irish help, which was freely given, the British government felt it expedient to make certain trade concessions to Ireland, and to conciliate the Catholics, in case they should be tempted to join forces with the Patriots. Relief acts removed some of the worst of the Penal Laws. But the vital step was taken when the offer of the Patriot Party to raise a volunteer force for the defense of Ireland, against a threatened French invasion, was accepted. The Volunteers, a predominantly Protestant body led by the duke of Leinster in the south and the earl of Charlemont in the north, became first a fashionable and then a formidable force; and when their moral support was ranged behind the Patriots in their campaign to secure reform, the British government had to be told that the movement had become too strong to be resisted. The disasters in America had driven Lord North from office in Britain; and the new Whig government sent the duke of Portland to Ireland as lord lieutenant, prepared to concede parliamentary independence. The Declaratory Act was repealed, and in May 1782 Ireland, in Grattan's words, became a nation.

Or so it seemed, to judge by the popular rejoicing. But very quickly, certain weaknesses in the new constitution were revealed. Legislative independence might have been established in theory, but the practical limitations to effective self-government remained formidable. The lord lieutenant and his secretaries of state, in whose hands lay the executive power, were English nominees. Had the legislature been more representative and independent it could, by withholding supplies, have bound the executive to its will; but the majority of the seats in the Commons were controlled by a few powerful landowners, whose adhesion to the executive proved to be easily purchasable by pensions and promises of titles, honors, and awards. The judiciary were

likewise dependent upon "the Castle"—the seat in Dublin of the Irish executive—for their advancement.

Party Strife.—No sooner had independence been gained than the Patriot Party suffered from a split which materially lessened its chance to reform the constitution that it had just won. Flood and Grattan quarreled, giving the Castle the opportunity to consolidate its hold upon the Commons; the Volunteer movement lost its impetus, and the Patriots their power. By 1784 the Irish Commons were scarcely less under the executive's thumb than they had been earlier in the century.

The venality of Parliament did not, however, prevent the enactment of commercial regulations that did much to revive Irish prosperity. The Corn Law brought in by the Irish chancellor of the exchequer, John Foster, was to make Ireland one of England's chief granaries for the next half a century. In 1785 the agreement of William Pitt, who had become prime minister in Britain, was obtained to some commercial propositions that would, if carried, have put the two countries on almost equal trading terms. The propositions passed through the Irish Parliament, but English commercial interests, their fear of Irish competition aroused, procured such substantial amendments that the bill became unacceptable to the Irish legislature, and had to be withdrawn. That so much British opposition had been aroused was, however, in itself a tribute to the growing commercial vitality of the Irish nation that characterized the period.

The government's hold over the legislature was not shaken until 1789, when the possibility that the Prince of Wales, whose Whig sympathies were well known, might become regent during George III's madness, induced many members to join Grattan in supporting the prince's claims. But the king recovered his sanity; the Castle restored its majority by a lavish creation of peerages and pensions; and the rekindled hopes of the Patriots were again quenched. Thereafter the feeling began to grow in Ireland, fostered by the success of the revolutionaries in France, that constitutional changes could only be won, as they had been in 1782, by threat of force. In 1791 Wolfe Tone founded the Society of United Irishmen in Belfast, where the nucleus of the organization was provided by the northern dissenters, still sufferers to only a less degree than Catholics under the Penal Laws. The society spread rapidly over the country, mainly among the Protestant middle class. At the same time, the Catholic movement showed signs of revival. A deputation that laid its grievances before George III in London was received with sufficient royal favor to secure a further measure of relief, giving Catholics the vote, subject to a property qualification. They were, however, still excluded from the Parliament.

Their success encouraged the United Irishmen to press more strongly for electoral reform. The government, alarmed at hints that force might be used if peaceable methods failed, prosecuted Hamilton Rowan and others of the society's leaders in 1794. The movement was driven underground, losing its more law-abiding elements, and gradually taking on the characteristics of a conspiracy.

Rebellion.—The last chance that the electoral problem might be settled peaceably was lost when

Lord Fitzwilliam was recalled in 1795 from the viceroyalty that he had held for only a few weeks. He had come determined to carry a measure of Catholic emancipation, and had made a beginning by removing from office some of the ultra-Protestant officeholders who had installed themselves after 1782. They had powerful friends in Britain who succeeded in alarming Pitt; Fitzwilliam was replaced by Lord Camden, and the "ultras" were restored. The new lord lieutenant resolved to meet the growing revolutionary threat with coercion. A severe Insurrection Act was followed in 1796 by the suspension of habeas corpus. The United Irishmen, in their turn, were driven to more extreme measures, and in the same year two comparatively new recruits to the movement from the ranks of the aristocracy, Lord Edward Fitzgerald and Arthur O'Connor, went to the continent to seek French assistance. Wolfe Tone, who had left Ireland earlier, was before them; and he succeeded in persuading the French to send a fleet with an expeditionary force to Ireland. He himself was on one of the ships that reached Bantry Bay at Christmas, 1796, but appalling weather prevented disembarkation of the troops, and the chance was lost.

The threatened invasion made the Castle intensify the campaign of coercion. The military were given almost unlimited license to use torture, flogging, and execution to exterminate the rebel movement. Grattan and his followers, who had clung to the hope of constitutional reform, left public life in disgust, and the United Irishmen, in loose association with the Defenders, a Catholic peasant movement, laid plans for insurrection with or without French aid. The United Ireland movement, however, was riddled with spies and informers, who reported its every step to the Castle; and before the date fixed for the outbreak, every prominent leader had been captured or killed. Nevertheless, the rebellion broke out in the spring of 1798. It was disorganized and ill led, doomed to failure from the start; only in the southeast did the rebels achieve even momentary success, and within a month the rising had been suppressed. A French force that arrived too late to be of any help was quickly rounded up; Tone was captured at sea; Fitzgerald had been killed trying to escape arrest; and the other leaders were prepared to secure their lives by relating in full the movement's history in a formal confession.

Union.—The rebellion confirmed the British government in a view with which Pitt had been toying for many years: that only in a union of the two countries could their mutual safety be secured against internal and external enemies. Early in 1799 the union was proposed in the Irish Parliament. The motion was defeated. The rebuff only made the Castle the more determined. The Catholics were won over with the promise of emancipation; the Protestants were reassured by the argument that Catholics could never be more than an impotent minority in the British Parliament at Westminster. Such propaganda still proving insufficient, large-scale purchase was resorted to. Lord Castlereagh was employed systematically and cynically to buy out enough opponents of the measure with places, pensions, and titles, to insure a majority. In 1800, in spite of a last eloquent appeal from Grattan, the Irish Parliament signed its own death warrant by passing the Act of Union; and

the nation that he had helped to create relinquished, for over a century, its nationhood.

BRIAN INGLIS.

HISTORY FROM 1800 TO 1922

Although the Act of Union in 1800 extinguished the Irish Parliament and transferred all legislative power to London, there had been hopes of relief from the oppression which had been exerted for years by the Protestant "ascendancy" in Ireland. William Pitt had gained much Catholic support for the Union by promising that it would be at once followed by the admission of Catholics to Parliament. Catholics had been entitled to vote in the Irish elections since 1793, and it was assumed that they would soon elect Catholic members and assert their rights. But George III vetoed Catholic emancipation, and Irish questions were left entirely in the hands of the ascendancy executive in Dublin Castle. An insurrection in Dublin headed by Robert Emmet in 1803 was easily suppressed; and the following years brought a steady decline of Irish industry and trade.

Such protection of Irish interests as had been provided by the Irish Parliament was now withdrawn. Dublin ceased to be the center of social and political life, and even those landowners who continued to sit in Parliament now attended in London instead of Dublin. Many more left Ireland entirely and became absentee landlords, exacting all that they could in rents, through middlemen who found during the Napoleonic wars that it was most profitable to divide estates into small holdings, at extortionate rents which could be paid while agricultural prices were high. This increase of small holdings, combined with complete neglect by the landlords to make any improvements, produced an appalling standard of living and of housing. Young laborers could become tenants of a few acres and build a wretched hovel, equal to anything that could be got later in life; and they married in great numbers, so that the population grew with abnormal rapidity for the next 40 years.

While poverty increased among the people, a new Catholic middle class was slowly arising since the relaxation of the anti-Catholic laws. They had been excluded for generations from owning land, or even from practicing certain trades, and all the professions. But many of them had become prosperous through trade with France and other countries, and their sons could now become lawyers or doctors, though they could not enter public life.

Catholic Emancipation.—The new generation found a leader in the Catholic barrister, Daniel O'Connell, who devised means of conducting an agitation for Catholic rights within the law. By insisting on the right to petition Parliament, and by using the courts as a platform when he defended in political prosecutions, he aroused such a formidable agitation that in 1815 he could have won the admission of Catholics to Parliament, if he had accepted the proposed British veto on the appointment of Irish bishops. But he refused all such terms, and allowed the agitation to subside until 1823, when he founded the Catholic Association on a broad democratic basis, with a vast membership subscribing a penny a month. All Catholic Ireland supported his popular agita-

tion, and in 1828 he was elected for County Clare as a Catholic candidate who would not take his seat until the oath against the Catholic religion was abolished. The duke of Wellington, British prime minister, feared civil war, and in 1829, by threatening resignation, he compelled George IV to sign the Catholic Emancipation Act.

Catholics could now be elected to the British Parliament, but the Protestant ascendancy still owned most of the land and its wealth, and had a complete monopoly of power. But experience showed that without a national legislature, there was no hope of economic and social reforms. O'Connell abandoned his legal career to become the leader of a national movement for repeal of the Act of Union. His attempts to continue political agitation on the former lines were suppressed by the Whig ministry which was elected in 1831 to carry parliamentary reform in Britain, and for ten years O'Connell gave the Whigs a chance to fulfill their promises to improve Irish conditions. But in 1840 he decided to revive the popular agitation, by his old method of collecting small subscriptions from the people.

After a discouraging start, he found new support from a group of young men who founded the *Nation* newspaper in October 1842. They were led by Charles Gavan Duffy and Thomas Davis, who preached national recovery by promoting economic and cultural as well as political life. With their help, in 1843, a series of "monster meetings" was organized all over Ireland to demand repeal of the Union. The climax was to be a vast rally at Clontarf in October; but the government blocked all the approaches with troops and artillery, and O'Connell had to cancel the meeting. Soon afterwards he and all the prominent leaders were prosecuted for seditious conspiracy and imprisoned.

Potato Famine.—An appeal against their sentence succeeded unexpectedly, but when O'Connell came out of prison his health and his nerve were broken. The young men became impatient of his appeals for caution, and conflict had already arisen between him and the Young Ireland Party before Davis died suddenly in September 1845. Duffy then gathered a group of still younger men around the *Nation* newspaper, and the events which followed drove them to revolutionary policies. The population had increased very rapidly to 8¼ millions by 1845, and the standard of living was so low that a large proportion subsisted almost entirely on potatoes. In 1845 the potato blight, of which both the cause and the remedy were still unknown, reached Ireland, and produced a famine which became devastating when the potato crop was again ruined in 1846 and 1847. Fully half a million people died directly from starvation or from typhus and cholera. Millions more were barely kept alive by soup kitchens and the most meager relief, provided largely by private sources, much of it coming from America. A vast exodus by emigration began, and the roads were crowded with refugees heading for the ports to escape to Britain or the United States.

Young Ireland Rebellion.—O'Connell was slowly dying with softening of the brain, and he died at Genoa in May 1847. The Young Irelanders had already seceded from his Repeal Party, and they were appealing for organized resistance to prevent the export of food from Ireland, which only paid the landlords' rents. The bloodless revolution in Paris in January 1848, which

replaced Louis Philippe by a French republic, had encouraged Young Ireland with hopes of similar success in Ireland after the harvest. John Mitchel, a young Ulster Protestant, became the chief advocate of armed rebellion, and the government passed a Treason Felony Act under which he was convicted and deported. The military garrison was greatly increased, and the plans for a rising were forestalled by orders to arrest all the leaders. William Smith O'Brien and all those who were not yet arrested vainly attempted a rising in County Tipperary in June 1848. He, Thomas Francis Meagher, and others were sentenced to death for high treason, and next year they were deported to join Mitchel as convicts in Tasmania.

Fenians.—Many of the Young Irelanders escaped to America or to France, and in the following years devoted themselves to organizing Irish resistance overseas. The Fenian Brotherhood was formed as a secret society in the United States in 1858. It soon extended widely in Great Britain and Ireland, while its central direction remained in America. A fierce hatred of Britain resulted from the vast emigration which began with the great famine; and as the Irish population in America steadily increased, it became a powerful factor in foreign relations. In 1851 the Irish population had declined to 6½ millions, and it had lost 800,000 more by 1861. In Britain and in Ireland the Fenians provoked widespread alarm by acts of violence and political agitation; but another attempted rising in 1867 was easily put down.

Pressure from overseas and the fear of continued Fenian activities compelled the British Parliament to consider practical reforms. William Ewart Gladstone became leader of the Liberal Party in 1867, and as prime minister soon announced that he would disestablish (sunder the state connection of) the Protestant Church in Ireland, which still exacted tithes from an overwhelmingly Catholic people. He carried disestablishment in 1869, and in 1870 also secured passage of an Irish Land Act which conceded the tenant's right to security of tenure, so long as he could pay his rent, and to compensation for improvements. But emigration, chiefly to America, continued to drain away the most active young men and women for many years. The population fell steadily until 1921, when it was around 4,350,000. It became increasingly evident that only a national legislature could organize recovery.

Home Rule Movement.—In 1870 the Home Rule League was founded by an eminent Protestant lawyer, Isaac Butt, who had previously been a leading opponent of O'Connell's agitation for repeal of the Act of Union. Its demand for a subordinate parliament in Ireland was inspired neither by the sanguine nationalism of Young Ireland nor the bitter Fenian hatred of England; but it met with no success until a young Irish landlord, Charles Stewart Parnell, joined Butt's party and began to obstruct all parliamentary business. His unflinching and ruthless defiance in the British Parliament soon attracted other young members, and in 1878 he was elected leader of the Irish Nationalist Party. Butt and his earlier colleagues were soon displaced by such ardent young nationalists as T. M. Healy, William O'Brien, John Redmond, and John Dillon.

While Parnell produced chaos in the House of Commons by systematic obstructions, a new

movement for land reform in Ireland had been started by Michael Davitt. The son of an evicted tenant, he had been imprisoned as a Fenian convict in England. In 1879, after his release, he founded the Land League in the poorest districts of Ireland, to demand fair rents and fixity of tenure. On lines similar to the new trade unionism, he organized the small tenant farmers to resist evictions and refuse payment of exorbitant rents. A means of agitation which could not be prevented as illegal was found in "boycotting" all landlords who became involved in disputes with the Land League, which many of them opposed by threatening to evict those who joined it.

Parnell joined forces with Davitt's Land League and quickly galvanized the whole country by combining the agitations for Home Rule and for land reforms. He sought to obtain a "balance of power" at Westminster by forming a compact party of some 80 members; pledged to support any English party which conceded their demands. Gladstone soon yielded to this pressure by carrying his Land Act of 1881, which set up fair rent courts. Parnell was imprisoned for obstructing operation of the act, but was soon released, while both English parties (Liberals and Conservatives) made overtures about introducing a Home Rule bill. Gladstone split the Liberal Party by proclaiming Home Rule as his policy, and his first Home Rule bill, in 1886, was defeated in the Commons.

Support in Britain for Irish Home Rule had grown widely when Parnell's political career was suddenly wrecked in 1890 by his becoming involved in the divorce suit brought by his parliamentary colleague Capt. William Henry O'Shea. Gladstone then announced that he could not continue his alliance with Parnell, and the Irish Catholic bishops also demanded his resignation, but Parnell would make no concession. A bitter split developed, and only a small minority of Parnellites retained their seats. Parnell fought his opponents with fierce energy but died from exhaustion in 1891. Deprived of his leadership, the nationalist agitation made no progress. Gladstone made a second attempt with his Home Rule bill of 1893, but it was rejected by the House of Lords. Not until 1900 was the Irish Nationalist Party reunited, when John Dillon, who had led the anti-Parnellite majority, agreed to serve under Redmond.

Land Reform.—Years of Conservative government had killed all hopes of gaining Home Rule, when Arthur James Balfour, on becoming leader of the House of Commons in 1895, adopted a new Tory policy of introducing constructive reforms. Local government by elected councils was conceded; administrative departments were created to develop the western counties and to promote agriculture and technical instruction. And in 1903 the Irish Land Purchase Act induced the landlords to sell their estates on favorable terms to the state, which enabled the tenants to buy their farms by terminable annuities. But the drain of emigration continued, and economic progress was stagnant. The agitation for Home Rule lost the driving force that it had derived from being linked with the agitation for land reforms, which were now attained. Redmond's reunited Nationalist Party at Westminster could offer no more than a resumption of Parnell's tactics of independent opposition at Westminster.

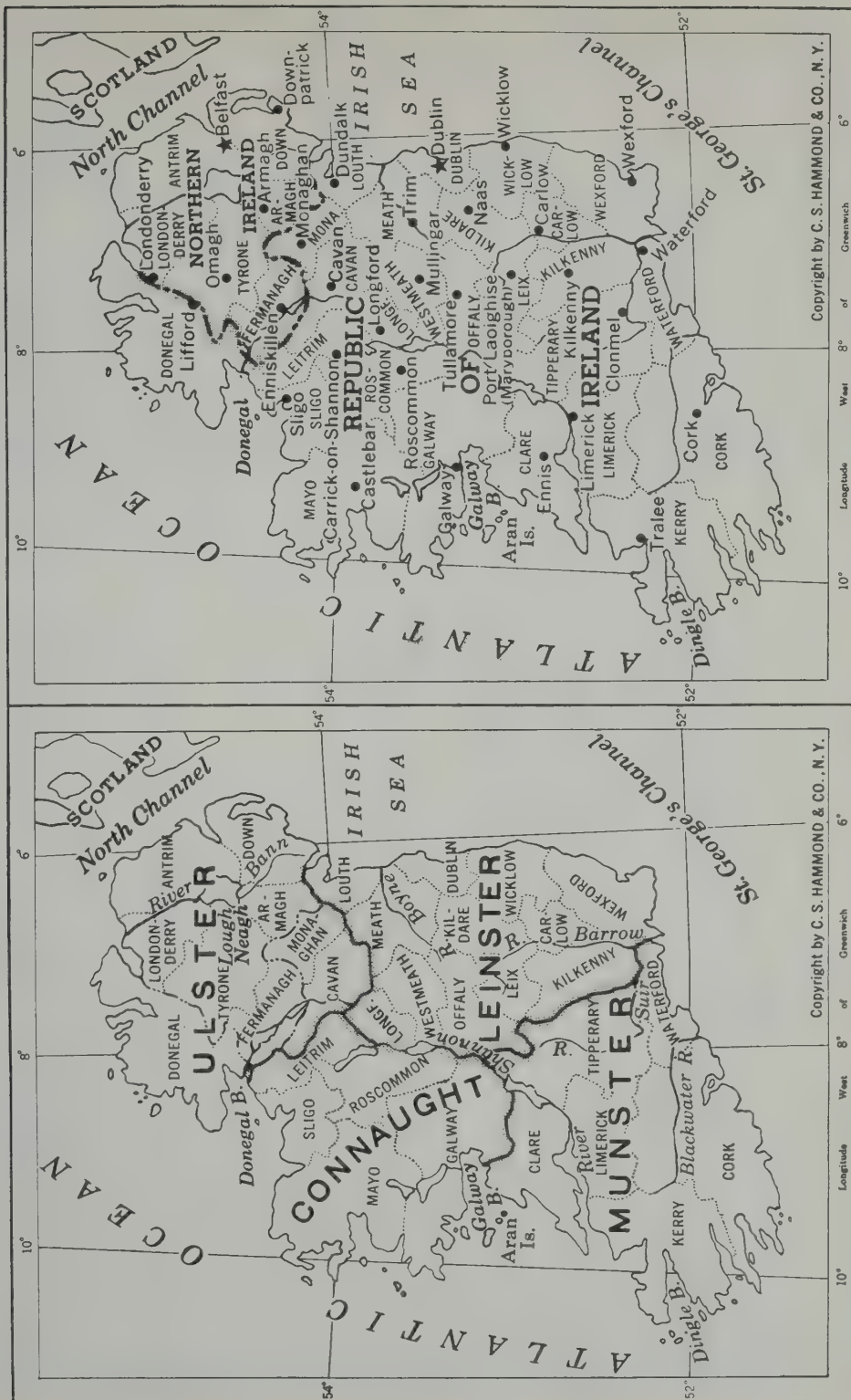
A new generation turned from politics to

revive the nationalist idealism of Young Ireland. Douglas Hyde and Eoin MacNeill founded the Gaelic League to preserve and revive the Irish language. There was a similar movement to promote Irish industries. Sir Horace Plunkett began to organize agricultural cooperative societies. Hopes of a Home Rule measure revived when the Liberals won a large majority in the House of Commons in 1903. But disgust with the failure of Liberal promises produced the rise of the Sinn Féin movement, led by Arthur Griffith, which demanded total withdrawal of the Irish members from Westminster, and an intensive reconstruction at home. The prospect changed when Redmond gained the balance of power in British politics, after David Lloyd George's radical budget of 1909 was thrown out by the House of Lords. Redmond promised full Irish support if the Liberals would introduce Home Rule. After the Lords' veto had been abolished in 1911 by the Parliament Act, the third Home Rule bill was introduced in 1912.

Ulster Opposition.—The Conservatives then adopted new methods under Andrew Bonar Law's leadership. They organized violent resistance to Home Rule in Ulster, where they had for years had a compact Unionist majority in the eastern counties around Belfast. In a reckless political campaign, all the leading Tory politicians encouraged the Ulster Unionist leader, Sir Edward Carson, in organizing a provisional government in Belfast. They exploited openly the anti-Irish sympathies of most officers in the British army, which produced a mutiny in March 1914, when the cavalry officers at the Curragh (a military training camp in southern Ireland) resigned their commissions rather than move into Ulster. The younger nationalists formed a national force of Irish Volunteers to assert their rights. Both forces obtained arms in defiance of government prohibitions, and civil war seemed imminent.

The sudden declaration of war against Germany in August 1914, compelled Prime Minister Herbert Asquith to postpone implementation of the Home Rule Act, passed in September, in order to placate the Conservative opposition and restore national unity. Redmond had a sincere reverence for the British Empire as a federation of self-governing Dominions, and he gave his immediate support to Asquith. He asked the government to leave the defense of Ireland jointly to the Irish and the Ulster Volunteers, and undertook to raise divisions of Irish recruits for active service. But the anti-Irish influences at the War Office under Lord Kitchener prevailed. A strong reaction in Ireland set in against Redmond's recruiting appeals, while nationalist meetings and propaganda were suppressed by the government.

Easter Rebellion, 1916.—Meanwhile the Fenian organization had decided to provoke an armed rising in Ireland while Britain was involved in a European war. Its small and secret membership grew as political repression increased. On Easter Monday, 1916, a sudden rising by less than 2,000 men in Dublin, under the leadership of Patrick Pearse and James Connolly, seized the General Post Office and other buildings and proclaimed an Irish republic. They held out for six days while British forces devastated much of the city. Most of the leaders were sentenced to death, and several thousand political suspects were imprisoned or deported to Eng-



Ireland: The Republic and Northern Ireland.

land. The executions were protracted over many weeks, and sympathy for the republic swept the country.

Thereafter, anti-English sentiment grew rapidly, and Sinn Féin candidates won many parliamentary elections. Prime Minister Lloyd George attempted both in 1916 and 1917 to produce an agreed settlement, but the Ulster Unionists demanded exclusion when the Home Rule Act of 1914 should be put into operation. In December 1918, the general election gave an overwhelming victory to Sinn Féin candidates, who demanded an independent republic for all Ireland. Many of them were still in prison but Eamon de Valera had escaped to the United States, and aroused powerful support. The Sinn Féin members of the House of Commons constituted themselves an Irish legislature as Dail Eireann in Dublin in January 1919, and proclaimed the formal constitution of a republic. Lloyd George poured troops into Ireland; and when most of the Irish police resigned, he enrolled recruits from England and reinforced them by a special Auxiliary Force (Black-and-Tans) consisting of demobilized army officers. The Irish Republican Army retaliated by guerrilla warfare. A campaign of systematic reprisals by the British forces included the murder of mayors and local leaders, and the burning of many villages and towns, which culminated in setting fire to a large part of the city of Cork.

Irish Free State.—Lloyd George's brutal methods in Ireland had brought disgrace upon British prestige. Another Home Rule Act, passed in 1920, created two Irish parliaments with very limited powers, one for the six eastern counties of Ulster (of which two had nationalist majorities) and the other for the remaining 26 counties. The Northern Ireland Parliament was formally opened in Belfast in June 1921. But the Irish members had refused to constitute the other Parliament. After secret negotiations Lloyd George formally invited de Valera to London in July to discuss the future. Insisting on absolute equality of status with Britain, de Valera appointed Arthur Griffith and Michael Collins, with other plenipotentiaries, to meet the British Cabinet. As a result the Anglo-Irish Treaty was concluded in London in December 1921, after Lloyd George had delivered an ultimatum threatening "immediate and terrible war" in Ireland if it was not signed at once. Under this threat the Irish delegates accepted certain conditions, including the oath of allegiance to the British Crown, which de Valera had ordered them to resist. But on the main issue there was general consent. An Irish Free State, with Dominion status equal to that of Canada, was established for all Ireland except the six excluded Ulster counties, with provision for their future inclusion by consent.

When the terms of the treaty reached Dublin, de Valera repudiated them. A provisional government was formed by Griffith and Collins, all British forces were rapidly evacuated from Ireland, and the whole administration was handed over. A long and bitter debate in Dail Eireann resulted in ratification of the treaty by 64 votes to 57. But de Valera refused to accept it. A civil war soon developed, and for some months de Valera's forces occupied a large area of the southwest. Griffith died suddenly from overstrain in August 1922, and a week later Collins was shot in an ambush in west Cork. The gov-

ernment was then led by W. T. Cosgrave. Holding office until 1932, it created the framework of the new state and laid the foundations of national recovery.

See also IRELAND, REPUBLIC OF; IRISH ARCHAEOLOGY and succeeding articles on IRISH ART AND ARCHITECTURE; IRISH CHURCH HISTORY, etc.; NORTHERN IRELAND.

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D. G.

IRELAND, Republic of. The present state of the Republic of Ireland was established in 1922. In the article IRELAND (q.v.) the geographic and other physical features and the historical background of the island are treated. In the present article the independent self-governing area of Ireland is described under subsections Area and Population, Constitution, Politics, Defense Organization, Education, Culture, Religion, Agriculture, Industry, External Trade, and Communications.

Area and Population.—The provinces of Leinster, Munster, Connacht and three counties of Ulster (the other six Ulster counties are in Northern Ireland, q.v.) with a population in 1946 of 2,955,107 and an area of 26,602 square miles are governed by an independent republican Parliament. Leinster, which covers 7,581 square miles on the east and southeast, contains twelve counties, Carlow, Dublin, Kildare, Kilkenny, Laoighis (formerly Queen's County), Longford, Louth, Meath, Offaly (formerly King's County), Westmeath, Wexford, and Wicklow, and had a total population in 1946 of 1,281,117. Practically half of this number, 550,725, live in



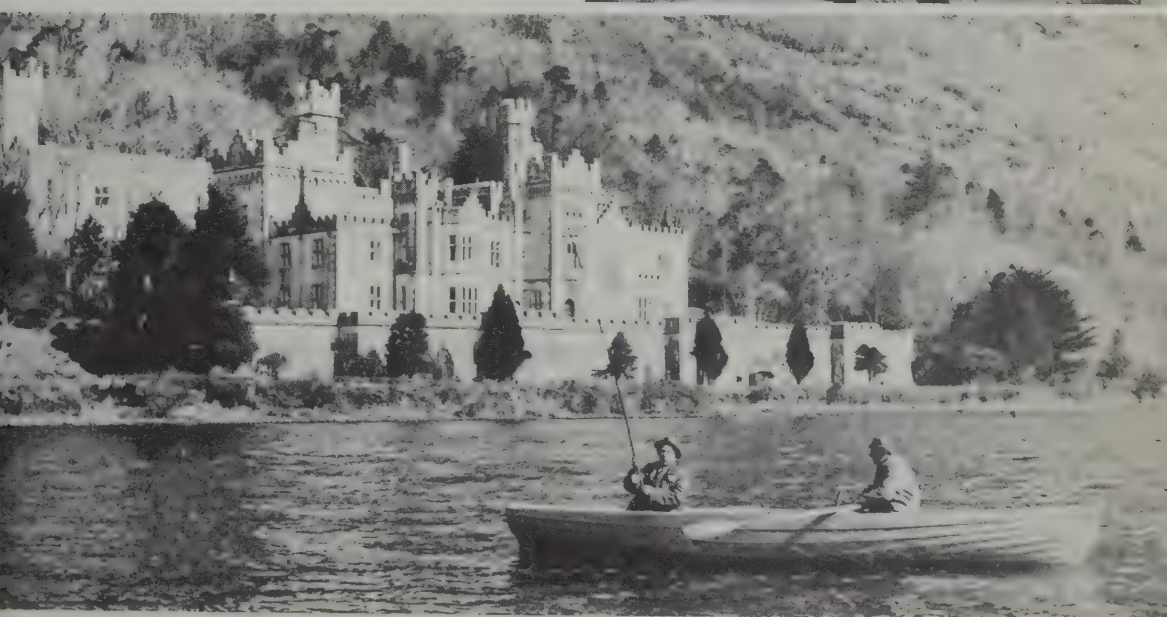
Top: The Rock of Cashel in Tipperary. Close by the roofless 13th century cathedral stand a round tower (right) and Cormac's Chapel, 12th century, with its high-pitched roof (left).

REPUBLIC OF IRELAND

Right: Coracles, boats of tarpaulin stretched on a frame, on the shore near Ballyferrier, Kerry.

Top photograph courtesy Irish Tourist Office; others from Combine Photos Ltd.

Bottom: Fishing on a small lake in Galway before Kylemore Abbey, a 19th century mansion turned guesthouse and school.





Top: The river Moy at Ballina, County Mayo.



Center: Peat stored in Phoenix Park, Dublin, being loaded for distribution.

Center photograph from Wide World; others courtesy Irish Tourist Bureau



Bottom: Rural scene in the highlands of Donegal.

the capital city, Dublin, and its suburbs. The density of population in the rural areas is mainly between 60 and 120 per square mile. The principal towns, after the metropolis, are Dundalk (population 18,562), Drogheda (population 15,715), Wexford (population 12,296), and Kilkenny (population 10,291). Munster, in the southwest, is 9,317 square miles in area and is divided into counties Clare, Cork, Kerry, Limerick, Tipperary, and Waterford. Its population, 917,306, is spread at much the same density as in Leinster in the rural areas of Limerick, north Cork, and Waterford. In the other counties the density is higher, particularly in Kerry, in some parts of which it is between 200 and 300 persons per square mile. The largest city is Cork (population 89,877), on the south coast, which has a good harbor. The cities of Waterford (population 28,269) and Limerick (population 42,970) are the other main population centers in the province. Galway, Leitrim, Mayo, Roscommon, and Sligo, the five counties of Connacht, cover 6,611 square miles of mainly rugged land in the West. The population totaled 492,797 in 1946. Despite the poverty of the soil the density of the rural population is great, a few districts along the seaboard having between 300 and 400 persons per square mile. In south Mayo the population density per square mile is between 200 and 300, while in the rest of the province it ranges between 100 and 200. The principal urban centers are Galway (population 20,370) and Sligo (population 12,920). The three counties of Ulster under the jurisdiction of the Republic of Ireland are Donegal, the most northerly county in the island, Cavan, and Monaghan. Their area is 3,093 square miles and population was 263,887 in 1946. The population density of these counties, except west Donegal, is between 100 and 200 per square mile. In the coastal districts on the west it is higher, being over 400 per square mile in some parts. There are no large urban centers, as the centers of trade for these areas lie mainly in Northern Ireland. While the south, west, and most of the east limits of the republic are the sea coast, on the northeast there is a land frontier 240 miles long through Ulster. Donegal, which lies alongside this boundary, has but a tenuous land connection five miles long with the rest of the republic. In general, the natural increase in population of the country is offset by emigration, which is mainly to Great Britain. Under native government the emigration rate has declined considerably.

Constitution.—The republic is governed under the constitution passed by plebiscite in 1937. The national Parliament consists of the president and two houses—Dail Eireann (House of Representatives) and Seanad Eireann (Senate). The president is elected by the direct vote of the people, and holds office for seven years. On the advice of the head of the government he summons and dissolves Dail Eireann, and he appoints the prime minister (Taoiseach) on the nomination of Dail Eireann. The supreme command of the defense forces is vested in the president, who is aided and advised in carrying out his functions by a Council of State. The representative house of Parliament consists of 147 members elected by adult suffrage under a system of proportional representation. The Senate has 60 members, 11 of whom are nominated by the Taoiseach, 6 are elected by the universities, and

the remaining 43 are elected on a vocational basis which allots representatives to cultural, industrial, labor, agricultural, and administrative interests. The Senate has no power to veto legislative proposals, and is allowed a maximum of 90 days to consider and amend bills sent to it by the Dail.

The executive power of the state is exercised by the government, which is responsible to Dail Eireann and may consist of not less than seven and not more than 15 members. The prime minister nominates the members of the government, who are appointed by the president after being approved by the Dail. Each member of the government has charge of a department of state and is the minister responsible to the Parliament for that department. The departments are finance, agriculture, external affairs, justice, local government, education, lands, industry and commerce, posts and telegraphs, defense, and health and social welfare.

The constitution setting out the organization of government states the fundamental civil rights of the citizens and makes provision for the protection of the personal liberty, freedom of conscience, and free expression of opinion of the citizens. No amendment of the constitution can be made except with the approval of the people given at a referendum, and any legislation passed by the Parliament which infringes the constitution is invalid. The courts of justice may be called on to act as an independent arbiter to decide whether a statute is repugnant to the constitution or otherwise. The courts of justice consist of a Supreme Court, a High Court, a Court of Criminal Appeal, a Central Criminal Court, a Circuit Court, and a District Court. The judges are independent in the exercise of their functions, but administrative functions in connection with the organization of the courts are carried out by the minister for justice, who has the responsibility for the enforcement of law. He controls the police force, which does not carry firearms.

Politics.—Fianna Fail, led by Eamon de Valera (who was in 1938 president of the Assembly of the League of Nations), was in 1951 the largest political party in Dail Eireann, having almost one half of the seats. Against this party, which held office from 1932 to 1948, was an alignment of smaller parties. Of these, Fine Gael is the largest; its principal figures are Richard Mulcahy and John A. Costello (who was Taoiseach from 1948 to 1951). William Norton is the leader of the Labour Party, which is rather small as organized workers tend to vote for other parties. Its main strength is in rural rather than urban areas. Clann na Talmhan, a party which is almost completely confined to Connacht, is led by Joseph Blowick; it is interested mainly in the problems of small holders in the west. A small party led by Sean MacBride (minister for external affairs in 1948–1951) entered the political arena in 1948 and helped to defeat de Valera. This party, Clann na Poblachta, suffered an eclipse in the 1951 general election. Independent deputies maintain the balance of power between Fianna Fail and the other parties, and the election of a government depends frequently on their support. Differences in policy between the parties are slight. There is unanimous opposition to the continuance of partition, the severance of the six Ulster counties from the jurisdiction of the Irish Parliament. Partition conditions foreign policy, on which

there is also unanimity. While being anti-Communist, all parties have decided on a policy of neutrality in the event of war. As long as partition is maintained by Britain the Irish government will not enter into a military alliance with the anti-Communist countries. The government felt that to join the Atlantic Pact, one clause of which guaranteed existing frontiers, would mean the recognition of the border as permanent. All parties are pledged to a scheme of social welfare, the extension of health services, and the provisions of adequate housing. The actual differences between the parties arise more from personalities and past history. There are Irish ambassadors in the United States of America, Spain, the Vatican, Great Britain, France, Canada, and Australia, and Irish representatives also in Switzerland, Portugal, Norway and Sweden, Netherlands, Lebanon and Syria, Italy, Germany, Belgium, and Argentina. These countries have diplomatic representatives in Ireland. In international affairs, Ireland actively participates in the Organization for European Economic Cooperation and advocates closer European collaboration. Representatives of the republic attend the Council of Europe at Strasbourg, and the minister for external affairs is a member of that body's Committee of Ministers.

Defense Organization.—The Irish army had a strength of only 6,000 in December 1950. The Fianna Fail Party maintained that a permanent establishment of 12,500 is essential to form a well trained nucleus in the event of war. According to Fine Gael, 8,000 would be sufficient and as much as could be armed. As the republic is outside the Atlantic Pact, it finds great difficulty in obtaining military equipment. Besides the army, there is a small air corps and an Irish Naval Service whose main function is to patrol territorial waters and protect the fishing. The volunteer reserve, which undergoes annual training in camp, was 36,000 strong in 1950, about one fifth of its wartime strength. Recruitment to the defense forces is voluntary.

Education.—The constitution acknowledges the right and duty of parents to provide for the education of their children, and the state provides free primary or elementary education, which is compulsory up to the age of 14. The Department of Education pays grants to colleges for the training of teachers of all religious denominations, and it pays the teachers of primary schools. Secondary schools are under private control but are subject to examination by the department, which lays down the curriculum and gives grants on a capitation basis to the upkeep of the schools and pays the greater part of the teachers' salaries. Vocational schools, controlled by the local authorities and maintained partly out of local rates (taxes) and partly from grants from the central fund, are established in all the cities, the principal towns, and some rural areas. They provide technical training for apprentices to trades. University education is given at the three constituent colleges of the National University of Ireland—at Dublin, Cork, and Galway—and at the University of Dublin (Trinity College). The number of university students is over 7,000 each year.

Culture.—The teaching of the Irish language has a special place in Irish education. It is an essential part of the courses in primary and secondary schools, and it has a special place in university education. In many schools, all the

subjects, except English, are taught through the medium of Irish. This is because it is a policy laid down by all political parties to foster the native language, which declined considerably in the last 100 years of English rule and is now the everyday language of only some districts in the south and west. In the Institute for Advanced Studies, the government established schools of research in cosmic physics, higher mathematics, and Celtic studies; and the National Museum, National Library, and National Gallery, supported by the government, collect objects, books, manuscripts, and paintings of cultural and artistic value. Subventions are paid to cultural bodies—such as the Abbey Theatre and learned societies—and a scheme to coordinate artistic and cultural work under a director of fine arts was undertaken in 1951. (See also separate articles on CELTIC LANGUAGES; CELTIC PEOPLES; GAELIC LITERATURE; IRISH ARCHAEOLOGY; IRISH ART AND ARCHITECTURE; IRISH LITERARY REVIVAL; IRISH LITERATURE IN THE ENGLISH LANGUAGE; IRISH MUSIC.)

Religion.—The vast majority of the inhabitants of the republic are Roman Catholics—in fact, 94.3 per cent in 1946. The minority consisted of 4.2 per cent Protestant Episcopalians and less than 1 per cent Presbyterians. The Roman Catholic population is increasing since 1926, but the other religions are declining. The census for 1946 showed, however, an increase in the number of infants of the Protestant religions, but the birth rate among Roman Catholics is consistently higher than that among the other religions. Protestants are much fewer in the provinces of Munster and Connacht than in Leinster, but they are most numerous in the three Ulster counties. They are stronger in urban than in rural areas. All the churches are organized on an all-Ireland basis; both the Roman Catholic and Episcopalian primatial sees are at Armagh, in Northern Ireland. The constitution guarantees freedom of religion, and religious differences are not the lines of political division. Each political party has members of all religious persuasions, and various members of the government have been Protestants, as was the first president under the 1937 Constitution, Dr. Douglas Hyde. The most important of the minor religious groups in 1946 were the 8,355 Methodists and the 3,907 Jews. Practically all the Jews were in Dublin city, where they have a flourishing community. The Society of Friends is a small body numerically but plays an important part in commercial life. See also IRISH CHURCH HISTORY.

Agriculture.—Farming is the largest single industry in the country, and practically one half of the workers are employed directly on the land. Three quarters of those engaged in agriculture are farmers and their families, while the paid agricultural employees are but one quarter of those in the industry. The size of farms may reasonably be divided into three groups—subsistence holdings under 30 acres, medium farms between 30 and 100 acres, and large farms over 100 acres. The smallest group predominate in Connacht and the three Ulster counties, while the medium farms are more usual in the other provinces. The largest holdings, which are most common on the rich grasslands of the limestone central plain, play an important part as fattening lands in the country's cattle export trade. More typical, however, of Irish agriculture is mixed farming, in which tillage provides mainly for



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Top: Glendalough, "The Glen of Two Lakes" in County Wicklow, site of a once-flourishing monastic settlement. The round tower (center) is one of the principal remains. Bottom: New Street, Killarney, County Kerry, during a horse fair, which attracts dealers from all parts of Ireland.

Photographs courtesy Irish Tourist Bureau





Combine Photos Ltd.

Top Thatched cottage in rocky country near Costello in Galway. *Bottom* Carts going down the road to Cloghane, situated on an inlet of Brandon Bay in County Kerry.

Courtesy Irish Tourist Bureau



the feeding of livestock with perhaps some barley, wheat, and sugar beet for sale. The farmers' main business is the breeding and rearing of livestock, principally cattle. Pigs are reared mainly on the small farms, on which poultry rearing is also a usual side line; there are few specialized poultry farms. Sheep are reared on the uplands and brought to the lowlands for fattening. Dairying predominates in Munster, where the cooperative movement, owing its origin at the end of the 19th century to Sir Horace Plunkett, inspired the establishment of creameries. Fishing is but of local importance and gives little employment. Before World War II the total agricultural output was absorbed almost equally into three channels—consumption on the farms, the home market, and the export trade. Between 1939 and 1945 the export trade consumed only one fifth of the output, but in the postwar years this increased to practically the prewar position. During the war the country had to produce to meet the needs of the home population. Much more wheat was grown and, like other countries, the farmlands were not adequately fertilized. To provide food for the home market, a system of compulsory tillage was introduced. As a result, at the end of the war in 1945 the soil was depleted and agricultural output had fallen. In 1949 a ten-year scheme of land rehabilitation was initiated by the Irish government for the improvement of farms. Drainage is the main part of the project, which plans to reclaim 4.5 million acres of nonproductive or underproductive land. The Department of Agriculture gives credit facilities to enable farmers to purchase fertilizers. This work received aid mainly by loans from the United States under the European Recovery Program.

Industry.—Ireland's poverty in mineral deposits and its political domination by England in the 19th century are among the reasons why it had little industrial development. In the republic, however, since the foundation of the state efforts have been made to produce power in the country instead of depending on imported coal. The Shannon hydroelectric station, constructed between 1925 and 1929, initiated modern power development; 40 per cent of the Shannon supply is used for industrial purposes, and the demand for electricity led to further hydroelectric development on the rivers Liffey, Erne, and Lee. Electricity is made available throughout the country, and is applied to agriculture under a rural scheme organized by the Electricity Supply Board, a state company which controls electrical development. Modern mechanical methods are used by another state company, the Turf Board, which is helping to replace imported fuel by producing peat from Irish bogs. The virtual collapse in the supply of imported fuel during World War II caused greater dependence on peat than ever before, and in the years after the war a plant was erected to use peat for the generation of electricity. The first peat-fired generating station was established at Portarlinton, in County Laoighis, on the bog which extends across the central plain of Ireland. Industry expanded after 1922 and continues to develop. In 1950, one fifth of the working population was engaged in industry, as against one tenth in 1926. Government planning achieved a scattering of industry, and many small towns were revitalized by the location of new factories in them. There is a social as well as an economic aspect in the policy

of industrial development, in that it brings employment to rural towns and helps to keep the population rural while reducing dependence on foreign suppliers for products which can be produced in the country. A number of industries depend for their raw material on agriculture. Bacon factories and meat-canning plants are scattered throughout the state. Sugar-beet processing is carried on at Carlow, Thurles, Mallow, and Tuam and these practically supply all the home needs in sugar. Beverages are manufactured mainly from barley, and by far the largest brewery is that of Guinness, located in Dublin.

A third of the agricultural machinery used by farmers is made in the country. Leather and clothing manufacture rapidly expanded under native government. Light industries dependent for raw materials on foreign imports—such as the making of aluminum utensils, enamelware, electric bulbs, and electrical equipment—were set up to supply the home market. This rapid expansion of industry was carried out despite the lack in the initial stages of skilled labor, and the result was felt during World War II, when the republic suffered much less from wartime shortages than might have been expected had the industries not been established. The establishment of cement factories has provided material for a drive initiated by the state to provide adequate housing. In 1926, 27.2 per cent of the population was badly housed, but by 1946 this was reduced to 16.8 per cent.

External Trade.—Agricultural products are the mainstay of the export trade of the republic. Live cattle are roughly one third of the total annual exports. Eggs, meat, beer, stout, and Irish whisky are other substantial items of export. The traditional customer for these is Britain, which purchases three quarters of the total exports. This position is kept up by trade agreements, which guarantee to the republic prices on a long-term basis and commits Britain to supplying certain quantities of coal and raw materials in return. These guaranteed prices are usually tied to those paid to the English farmer, and increases to home producers in Britain benefit Irish farmers. In return, the republic is committed to send most of its exportable surplus of foodstuffs to Britain. One eighth of the total exports of the republic go to Northern Ireland, and about one half of that to other European countries. Exports to the United States of America are negligible. The principal Irish imports are machinery and electrical goods, textiles, coal, vehicles and parts, maize (corn), mineral oils, fats, and motor spirit. Consumption goods are less than one third of the imports, while the rest is made up of materials for industry and agriculture and other capital development. More than one half of the republic's imports are from Britain and, despite its small size, the republic ranks about fifth among Britain's customers. Imports from the United States of America are second in importance, and are slightly greater than those from the continent of Europe. There is a substantial deficit between the value of exports and imports, which is met largely by invisible income. The most important item of invisible income derives from tourist traffic, which is encouraged by the government. Tourist receipts are a tribute to the charms of Ireland as a holiday resort and also to the abundance and variety of food available at moderate cost. British visitors in the years after World War II took ad-

vantage of the nearness of Ireland to escape the austerity imposed on them in England, while the international reputation of the beauty spots of Wicklow, Connemara, and Killarney, and the abundant fishing, shooting, and hunting facilities, attracted many. Another source of invisible income is interest on external assets. In 1920 the republic had substantial investments in Britain, and these were increased during World War II, when there was a reduction in imports. After 1945 some of these investments were repatriated to cover capital development in Ireland and to meet the deficiency between income and expenditure—which was due to the purchase of machinery. One of the difficulties of Irish trade is the disparity between dollar expenditure and dollar earnings. In the years between the first and second world wars this did not create any problem, due to the convertibility of sterling into dollars. The development of the dollar-earning potentialities of the tourist trade helped, after 1945, to meet Ireland's dollar deficit.

Communications.—The rail, road, and canal transport services in the greater part of the republic are nationalized, being operated by Coras Iompair Eireann. The roads are maintained by local county councils, aided by grants from the government; they are the basis of the Irish communications system. The nationalization of transport was essential to coordinate the three main services and to avoid the financial collapse of the railways. One of the major problems created by the partition of Ireland is in transport, as the Great Northern Railway has road and rail services on both sides of the border. The area served by this company, which is not nationalized, covers the north of Leinster and the Ulster counties, and is the link between Belfast, in Northern Ireland, and Dublin. The canals, which date from the 18th century, link Dublin to the Shannon and to the Barrow; they carry an appreciable amount of heavy goods, mainly fuel and agricultural produce. The railways carry much heavy freight as well as passengers; their financial position, however, is insecure, and many branch lines are closed as uneconomic. To help to maintain essential supplies during World War II, the government set up Irish Shipping Limited; it created a merchant fleet which was expanded in the postwar years. In air communications the republic has an important position, being on the western fringe of Europe. The customs-free airport at Shannon is an international air station and provides excellent facilities for the Atlantic air routes. A national air service is operated by Aer Lingus Teoranta, which operates direct services from Dublin Airport to Paris, Amsterdam, London, Liverpool, Glasgow, and Manchester. The Department of Posts and Telegraphs operates the telephonic service; there are automatic exchanges in the large cities. It also controls the radio service, which is paid for by the licensing of receivers; broadcasting is carried on from studios in Dublin and Cork on two medium wave lengths.

THOMAS P. O'NEILL,
National Library of Ireland.

HISTORY

The Irish Free State, antecedent to the Republic of Ireland, was established on Jan. 15, 1922, as outcome of the Anglo-Irish Treaty of Dec. 6, 1921, which gave Ireland the status of a

British dominion. The meetings of Irish and English representatives in the negotiations leading to the treaty were largely brought about and inspired by Sir John and Lady Lavery in that great portrait painter's studio in London. Six of Ulster's counties, however, which had accepted Home Rule in 1920, chose to remain part of the United Kingdom as Northern Ireland (q.v.). After long dispute, an agreement made on Dec. 3, 1925, fixed the boundary between the Irish Free State and Northern Ireland.

The year 1922 brought civil war in the Irish Free State, for that country was bitterly divided on the issue of accepting the treaty of 1921. On January 7 the Dail (Parliament) ratified the treaty by 64 votes to 57 and on the 14th, meeting as the Southern Parliament of Ireland, again ratified it. Meanwhile, on January 9 Eamon de Valera left the Dail, while Arthur Griffith as president and Michael Collins as premier prepared to implement the treaty according to their signed word. The text of the Irish Free State Constitution was published on June 15th. Elections for the Dail held the following day resulted in a majority for the new constitution of 58 members to 36. After the elections, there was a battle in Dublin for the Four Courts (the courts of justice) between the government forces and republican rebels, at the end of which the priceless records of Ireland went up in smoke. On July 6, de Valera declared civil war, accusing the provisional government of military dictatorship supported by British "big guns." The civil chaos overwhelmed Griffith's sensitive soul and he died August 12 mourned even by his opponents; William Cosgrave succeeded him as president of the Dail. The country suffered another loss on August 22 when Collins was killed in an ambush. The civil war continued until the end of May 1923. In August, the general election returned only 44 Republicans out of 153, for the people required peace even at the cost of accepting the treaty. De Valera refused from prison to take the oath of allegiance to Britain, a prerequisite to entering the Dail. Among the many schemes introduced by Cosgrave at this period were the sugar-beet industry and the Shannon Electrical Supply—"sweetness and light" in the words of Swift.

The Imperial Conference of 1926 in London led to the Statute of Westminster, which placed the dominions on an equal footing with Britain. In March, de Valera, putting aside Sinn Fein, formed the new Party of Fianna Fail (Warriors of Destiny). He finally took the oath of allegiance (no doubt under the Euripidean sense—"the tongue hath sworn but not the mind") and entered the Dail on July 9, 1927. Yet another leader was lost the following day, when Kevin O'Higgins, Cosgrave's leading minister, was assassinated. He had been in close communication with the British Cabinet on a scheme of Irish dominion unity. With O'Higgins passed any possibility of Ulster becoming a political part of Ireland for a generation. A Public Safety Act then passed widened the scope of treasonable acts.

By 1932 Fianna Fail had penetrated the country, at a general election winning 72 seats to 56 by Cumann na nGaedheal, Cosgrave's party; Independents and Labour held 24 seats. In July de Valera commenced an economic war against Great Britain, Ireland's chief customer, with results dubious to the economy of both countries. On Jan. 4, 1933, a further general election gave de Valera 77 seats to Cosgrave's 48, and others 17.

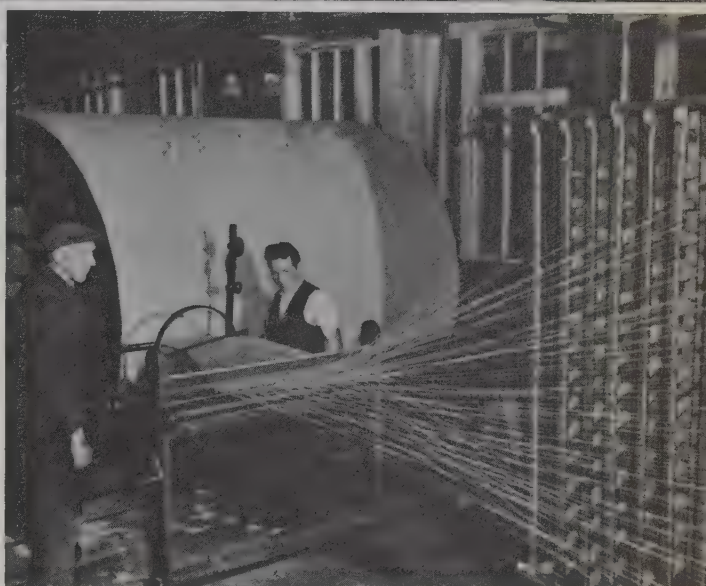


Top: Quay lined with shops at Wexford.

REPUBLIC OF IRELAND

Center: Scene in a woolen mill at Foxford, County Mayo.

Photographs courtesy Irish Tourist Bureau



Bottom: Patrick Street, in the heart of Cork.





Top left: One of Dublin's open-air butcher shops.

Top right: Streetside clothing market in Dublin.



Left: The massive keep of Blarney Castle, Cork, a typical Irish stronghold of the 15th century. Here for a modest fee one may kiss the Blarney Stone and become a persuasive talker for life.

Left photograph courtesy Irish Tourist Bureau; others Combine Photos Ltd.

Bottom right: Parish church at Ballyferriter, County Kerry.



On May 3 the oath of allegiance to Britain was abolished. In 1934 an important pact was made based on Irish cattle exports and coal imports from Britain, Ireland's main exchange always being meat for the product of the mines.

In 1936 the Constitutional Amendment Act removed the king from all internal authority in Ireland, and the office of governor general (held by James MacNeill in succession to Timothy Healy) was abolished. At the same time, by the External Relations Act the king's name was restored for use in external affairs, but subject to the orders of the Executive Council.

General elections on July 1, 1937, gave de Valera 69 against 48 Fine Gael, Labour 13, and Independents 8. On that date, also, a new constitution was approved by plebiscite; it went into operation on Dec. 29, 1937. In place of Irish Free State, the name Ireland (in Gaelic *Eire*) was restored; the constitution assumed the inclusion of Northern Ireland within the nation's territorial limits. De Valera made an agreement with Neville Chamberlain, British prime minister, on April 25, 1938, for the return of the ports of Cobh, Berehaven (Bearhaven), and Lough Swilly to Irish control. In June, de Valera obtained an overall majority, and Douglas Hyde, founder of the Gaelic League, was installed as president. As a result of the report of the Banking Commission, Irish currency remained tied to sterling. A Treason Act was passed in March 1939 because of the bombing campaign by the Irish Republican Army (then a revolutionary group) in Britain, and in April summary arrest and trial was declared for state offenses; the I.R.A. was outlawed on June 23. When World War II began in September, Ireland declared neutrality; it also objected in 1942 to the use of bases in Northern Ireland by United States forces. Though the government remained neutral, a large number of Irish volunteers from southern Ireland passed into the British services. The Irish names in the honor and casualty lists did much to mitigate the adverse effects of Ireland's neutrality in the British mind. The Shamrock Club, in London, preserved the names of 10,000 "neutrals in uniform."

In 1945 Sean T. O'Kelly was elected president of Ireland. During his presidency de Valera lost and then regained power. Under a coalition, on Dec. 2, 1948, the External Relations Act of 1936 was repealed by the Republic of Ireland Act, and thus the last link with the British Empire was broken. The Republic of Ireland was proclaimed on April 18, 1949.

The Irish Free State had been an active member of the League of Nations (de Valera served as president of the Council in 1932, and of the Assembly in 1938), but the republic was thrice denied membership in the United Nations by the veto of the Soviet Union. Nevertheless, Ireland was a member of six of the specialized agencies of the United Nations and also of the Organization for European Economic Cooperation, and in 1949 it became one of the sponsors of the Council of Europe. However, the republic refused to join the North Atlantic Treaty Organization, declaring that while it was in full sympathy with its aims it could not cooperate therein while the partition issue remained outstanding.

At the general elections of Feb. 4, 1948, de Valera's Fianna Fail Party had been placed in a minority by a coalition of parties under John Costello (Fine Gael, Clann na Poblachta, Clann

na Talmhan, and Labour). The new foreign minister, Sean MacBride, took the extreme but logical view of Irish Republicanism, and expounded it personally in Britain, France, and the United States. However, his party (Clann na Poblachta) was overwhelmingly defeated at the elections of May 30, 1951, and de Valera, without an overall majority, took office. His Fianna Fail Party won 69 seats, against 78 for all other parties. De Valera, surviving all recent history, continued to urge the ending of partition by "friendly approach" to Northern Ireland and the British government. Meantime, the vital questions of Irish life remained at the mercy of successive and bitterly divided factions on the issues of farming, fisheries, and forestry. Under the coalition, James Dillon advanced agriculture, and new efforts were made to replant a treeless island. Rural life was rapidly declining, owing to emigration of the youth to towns at home and abroad; Dublin had collected one sixth of the population of the whole republic. The youth (particularly the female) were leaving Ireland at every opportunity to work in Britain. To popularize rural life, the Muintir na Tire, a social, nonpolitical organization, was working efficiently under Father John M. Hayes. The census of April 8, 1951, showed that the population was still under three millions (provisional figure: 2,958,878).

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See also IRELAND; IRISH ARCHAEOLOGY, and succeeding articles on IRISH ART AND ARCHITECTURE, IRISH CHURCH HISTORY, etc.

SHANE LESLIE,

Baronet of Glaslough, County Monaghan.

IRELAND ISLAND, one of the Bermuda Islands. See BERMUDA.

IRENÆUS, *i-rē-nē'ūs*, **Saint**, Christian prelate, a father of the Greek Church: b. about 130; d. unknown. He was reared in Asia Minor, where he was a pupil of Polycarp, and became apostle of the Gauls. In 177 he was bishop of Lyon. According to tradition, he suffered martyrdom in the persecution under Emperor Septimius Severus.

IRENE, *i-rē-nē*, the name of three empresses of the Eastern Roman (Byzantine) Empire.

(1) **IRENE** (752-803), an Athenian by birth, was married in 769 to Leo IV, and following his death in 780 she became regent during the minority of their son, Constantine VI. Zealous for the re-establishment of image worship, she summoned a church council at Nicaea in 787 which decreed the restoration of images to the churches and defined the veneration due to them. When Constantine was proclaimed sole ruler in 790 she was forced to abdicate, but her title of empress was confirmed in 792. For five years she plotted to regain power, and in 797 she caused her son to be seized and put to death. Thereafter she was sole ruler until 802 when, the patricians having repudiated her in favor of Nicephorus, her minis-

ter of finance, she was dethroned. She was exiled to Lesbos, where she died the next year.

(2) **IRENE DUCAS** (1066?–?1120) was the wife of Emperor Alexius I Comnenus. After her husband's death in 1118 she conspired with her daughter, Anna Comnena (1083–?1148), to place the latter's husband, Nicephorus Bryennius, upon the throne instead of her own son, John II Comnenus. When the plot failed she and her daughter retired to a convent.

(3) **IRENE** (d. 1161) became, in 1146, the first wife of Emperor Manuel I Comnenus. The marriage had been arranged by her brother-in-law, Holy Roman Emperor Conrad III.

IRENE, i-rèn', **Sister**, Roman Catholic religious: b. London, England, May 12, 1823; d. New York City, Aug. 14, 1896. Originally named Catherine Fitzgibbon, in childhood she moved to the United States, and in January 1850 she joined the community of the Sisters of Charity, at Mount Saint Vincent, taking the name of Mary Irene. She became sister superior of Saint Peter's School, Barclay Street, New York City, in 1856, and in 1869 she founded, and became director of, the city's first home for deserted children, later known as the New York Foundling Hospital. She continued to head the institution until her death, and also founded the Seton Hospital for Incurables at Spuyten Duyvil.

IRETON, ir'tèn, **Henry**, English parliamentary commander and regicide: b. Attenborough, Nottinghamshire, 1611; d. Limerick, Ireland, Nov. 26, 1651. He was graduated at Trinity College, Oxford, and in 1629 took up the study of law at the Middle Temple. With outbreak of the civil war he joined the Parliamentarians, fighting at Edgehill in 1642 and Gainsborough in 1643, and in 1645 commanding the cavalry on the left wing of Oliver Cromwell's army at the Battle of Naseby; he was wounded and captured, but made his escape. In 1646 he married Cromwell's daughter, Bridget. From 1645 he was a member of Parliament, taking a prominent part in the negotiations which made that body subservient to the army. He helped frame the ordinances for the trial of Charles I, was one of the king's judges, and signed the death warrant. In 1649 he accompanied Cromwell to Ireland as second in command, and the next year was left by him in that island as lord deputy. He captured Carlow, Waterford, and Duncannon in 1650, and Limerick shortly before his death. Buried in Westminster Abbey, after the Restoration in 1660 his body was taken up, suspended from the gallows with that of Cromwell, and buried in the same pit.

IRGIZ, ir-gèz', river, Soviet Central Asia, in the west central part of the Kazakh Soviet Socialist Republic, 270 miles in length. It rises in the southeastern slopes of the Ural Mountains, and flows in a southeasterly direction to enter Lake Chelkar Tengiz (northeast of Lake Aral). The small town of Irgiz, on the river of that name, lies 220 miles southeast of Aktyubinsk; several caravan routes converge here. Another Irgiz River, 300 miles long, is a tributary of the Volga, which it joins opposite Volsk after a westerly course through the Kuibyshev Region.

IRIARTE, Tomás de, Spanish poet: b. Orotava (Tenerife, Canary Islands), Sept. 18,

1750; d. Madrid, Sept. 17, 1791. He was a nephew of Juan de Iriarte (q.v.) and was educated under the direction of his elder brother, Fray Juan Tomas de Iriarte, and later in Madrid with his uncle. At the age of 17 he wrote a drama (in verse), *Hacer que hacemos*, and at this early age he began translating dramas from French for the theaters of the city. So successful was he at this work that some of his original dramas were produced. On the death of his uncle in 1771, he succeeded him as official translator in the office of the secretary of state; and five years later he was appointed archivist to the supreme war council. In 1787 his works were published in six volumes in Madrid. A goodly part of his energies was taken up in quarrels with the critics of the day and with some of his literary contemporaries, the most notable of which was Juan Pablo Forner (1756–1797), who in turn, lashed him without pity, and sometimes without reason. Through the intrigues of his enemies Iriarte was summoned before the Inquisition in 1786, on the charge of propagating French heretical doctrines. But he was able to satisfy the ecclesiastical authorities as to his orthodoxy. Iriarte did much translation and wrote poems and dramas, and attempted other forms of literary work, but his fame today rests on his fables in verse, which are counted by far the best of their kind in Spanish. Their excellence is due not so much to the poetic talent of the author, which was not very great, as to the interesting form in which the fables are thrown, the ingenuity of many of them, their simplicity, vivacity, grace, and appearance of naturalness supported by fertility of invention. These *Fables* became immensely popular, and were translated into most of the languages of Europe. Perhaps the interest in them in Spain was increased by the belief that, under the guise of fable, Iriarte was holding up to ridicule many of his literary detractors.

IRIARTE, or **YRIARTE**, **Y OROPESA**, è-ryär'tà è ò-rò-pá'sà, **Juan de**, Spanish poet: b. Orotava, Tenerife, Canary Islands, Dec. 15, 1702; d. Madrid Aug. 23, 1771. He was the nephew of Tomas de Iriarte (q.v.). Educated in the College of Louis the Great, in Paris, he went to Madrid in 1724, where he became clerk in the Royal Library (1729) and ultimately librarian (1732). Owing to his linguistic ability he was appointed official translator to the secretary of state (1742); and the following year he was elected a member of the Academia Española. He composed hundreds of epigrams and sonnets, and also poems in Latin. Besides a Greek paleography, he published a notable catalog of the Greek manuscripts in the Royal Library.

IRIARTEA, ir-i-är'tè-à, a genus of palms, all South American, marked by smooth, tall stems and pinnate leaves with somewhat triangular leaflets. The best-known species is the pashuiba palm (*I. exorrhisa*), which has aerial roots. The wood is very hard.

IRIDACEAE, i-rì-dä'sè-è, in botany, a natural order of endogenous plants, mostly herbaceous, though a few are somewhat shrubby. They usually have either rootstocks or corms. The leaves generally are sword-shaped, in two rows and equitant. The perianth is six-partite and often very beautiful, in some regular, in

others irregular. There are three stamens, with the anthers bearing outward. The fruit is a three-celled, three-valved capsule. The family (the iris family) yields about 900 species in 60 widely distributed genera throughout the temperate and tropical zones. Some are hardy perennials, others for early summer growing, and there are a few hothouse varieties. Iris, gladiolus, and crocus are familiar examples of the order. Saffron and orrisroot are the principal economic products.

IRIDESCENCE, ĭr-ĭ-dĕs'ĕns, the intermingling and interchange of the spectrum colors on surfaces. Typical surfaces which produce iridescence are those of soap bubbles or mother-of-pearl. The iridescence is produced by the minute irregularities of the surface which, in reflecting white light, split it up into its constituent colors by the phenomenon of interference. The word comes from the Greek *iris*, meaning rainbow.

IRIDESCENT GLASS. See GLASS.

IRIDION (Polish *Irydyon*). The dismemberment of Poland, still more, the disastrous Polish revolution of 1830, had bred the sentiment of national hatred against the oppressors, but Count Zygmunt Krasinski (q.v.), in all his poetry, cautioned his people against hate as an expression of patriotism and preached inner perfection as a means of obtaining the highest good for his country. His work, *Iridion*, which appeared in Paris in 1836, is a poem-drama of exquisite beauty, based on Krasinski's reading of Montesquieu, Gibbon, and Niebuhr. In this poem he wished to give a picture of the fall of pagan Rome and the triumph of Christianity, and tried to show that it was not Greek hatred, but Christian humility, that renovated the Roman world. In the days of the domination and corruption of the Caesars, Iridion, who is represented as of Greek ancestry, sought vengeance against the Rome that had betrayed Athens and throttled Corinth. His mother was a priestess of Odin, and after her death he gave his sister to Heliogabalus, so that she might unsettle the emperor's mind. Iridion, as prefect of the Pretorians, urges Heliogabalus to conspire against Rome. The African Massinissa, versed in magic, persuades him to arm the Christians. Iridion, in the Catacombs, falls in love with a Christian maiden, who thinks that he will bring about the millennium. But just as he appears to be victorious, the bishop of Rome denounces his militancy. He returns to the northern gods of his mother. Heliogabalus and his sister perish. Massinissa tauntingly tells Iridion that Christ will some day rule over Rome, and puts him into a lethargic sleep. He does not awaken until 1835 in the north, but he now loves Christ's cross and has abandoned all ideas of revenge. *Iridion* was translated from the German and French by Martha Walker Cook, in *The Undivine Comedy and other Poems, by the Anonymous Poet of Poland, Count Sigismund Krasinsky* (Philadelphia 1875).

LEO WIENER.

IRIDIUM, ĭ-rĭd'ĭ-ŭm, a metallic element resembling platinum in its general properties, and occurring in nature in the metallic form, alloyed, usually, with platinum and osmium. It is found in the Soviet Union, South America, and Tasmania. Iridium was first definitely identified, in

1804, by Smithson Tennant, who found it in the residue left after dissolving platinum from its ore with aqua regia; in the residue was also found osmium, generally in alloy as irodoamine (q.v.). Separation of iridium from other metals which are included in the platinum group is difficult; for the usual processes employed, the more extended works on metallurgy and the chemistry of the metals must be consulted. Iridium is frequently obtained in the form of a spongy gray mass, or a gray powder; but by heating either of these to whiteness, and subjecting them to compression, the metal may be brought into the form of a compact, lustrous mass resembling steel. In this form it is harder than iron, and somewhat malleable when hot, though brittle when cold. At ordinary temperatures it has a specific gravity of about 22.4, being among the heaviest substances known. Its specific heat is about 0.0323 at ordinary temperatures, and its coefficient of linear expansion (Fahrenheit) is about 0.000039. Its melting point is very high, the estimates given by various authorities ranging from 3,600°F. to 4,500°F. Compact iridium, after being strongly heated, is insoluble in all acids, and is not affected by air or moisture. The metal has the symbol Ir. and an atomic weight of 193.1 if O = 16. It forms numerous salts.

IRIDOSMINE, ĭ-rĭ-dōz'mĭn, a natural alloy of iridium and osmium in varying proportions, is a hard, slightly malleable mineral, crystallizing in hexagonal prisms. It usually contains some platinum, and, frequently, other metals of the platinum group. While found with deposits of platinum in the Ural Mountains, and in small quantities elsewhere, its chief source is in placer deposits in southwestern Tasmania, discovered in 1925. No primary source for these placers has yet been found. This compound metal is silvery white and resists attack of all known acids, and hence is of great value in chemical and electrical industries. The Tasmanian metal is found in grains of such size and quality as to be immediately available for nibs of gold pens.

IRIGA, ĭ-rĕ-gā, town, Philippine Islands, in Camarines Sur Province, Luzon, 22 miles by rail southeast of Naga (formerly Nueva Caceres). Northeast of the town is an extinct volcano, of the same name, 4,023 feet above sea level. The town, the largest in the province, is located in a fertile agricultural region. Pop. (1939) 31,005.

IRIGOYEN, ĭ-rĕ-gō'yān, Hipolito, Argentine lawyer and statesman: b. Buenos Aires, 1850; d. there, July 3, 1933. He was of Basque ancestry. Following the revolution of 1890, in which he took an active part, he became leader of the Radical Party, opposed to the wealthy landowners. In 1916, with adoption of the secret ballot, he was elected president of the republic. He undertook a program of labor reforms, and opposed his country's entry into World War I in 1917. With expiry of his term in 1922 he retired from the presidency, being succeeded by Marcelo Torcuato de Alvear, likewise a member of the Radical Party. He was reelected president in 1928 for a six-year term, but disorders broke out in September 1930 and he was driven from the presidency by the Conservatives, led by José Francisco Uriburu. Released after a brief imprisonment on a warship, he became reconciled with Alvear, who was exiled in 1931. The two

were suspected of instigating the unsuccessful revolt of 1932.

IRIS, i'ris, in Greek mythology, daughter of Thaumás and Electra, sister of the Harpies, the fleet golden-winged messenger and servant of the Olympian gods, especially of Zeus and Hera. Iris was originally the personification of the rainbow, though she does not appear in the Homeric poems as the goddess of the rainbow. She is sometimes represented as a beautiful virgin with wings and a variegated dress, with a rainbow above her, or a cloud on her head exhibiting all the colors of the rainbow. Iris is the name of a planetoid.

IRIS. See **EYE**.

IRIS FAMILY, a family of monocotyledonous herbs, mostly perennials with tubers, corms, or rhizomes, and usually with an acrid flavor. About 800 species belonging to more than 50 genera have been described from temperate and tropical climates, mostly from South Africa and tropical America. They are characterized by two rows of leaves, the outer of which fit over and protect the inner (equitant); regular or irregular perfect flowers which are frequently handsome; perianth six-parted, the other floral organs in threes; and many-seeded, three-celled fruits (capsules). Some species have been used as food in countries where they are native; others furnish rootstocks which are used for making perfumes, especially orris; some few have been employed to a limited extent in medicine but the species most widely popular are cultivated for ornamental purposes. Of these last the most important genera are *Iris* (fleur-de-lis), *Gladiolus*, *Freesia*, *Crocus*, *Tigridia*, *Tritonia*, *Sisyrinchium*, *Ixia* and *Belamcanda*, elsewhere described.

The plants of the genus *Iris* constitute one of the chief ornaments of the northern regions of the globe, and usually grow in wet places, bearing flowers of various colors, but the prevailing tint is blue. The common wild iris or flag (*I. pseudacorus*), common in Europe and also found in the eastern United States, has yellow flowers of large size and long swordlike leaves. The gladdon or stinking iris (*I. foetidissima*) is a British species, with bluish flowers. The favorite garden sorts are mainly florists' varieties of the two species *I. germanica* (the German or bearded iris) and *I. laevigata* (the Japanese iris), and their hybrids with other types. Also used in gardens are *I. xiphoides* (the English iris); *I. persica* (Persian iris); and *I. susiana* (Chalcedonian iris). The roots of *I. florentina* supply the orris root of the drugstores. Several wild species are found in the United States.

IRISH ARCHAEOLOGY. Prehistoric and ancient remains in Ireland are noteworthy for three outstanding features: the importance of the Bronze Age; the great flowering of Early Christian art; and the wealth of field monuments to be seen throughout the country. The Bronze Age in Ireland is notable not only for the large amount of material—bronze, gold, burial pottery, and other objects, but also because of the influence exercised by Ireland on other areas. The Early Christian period saw the development of artistic endeavor which reached its zenith in the 8th century, was interrupted by the Viking invasions, but was ultimately enriched by them in the ac-

quisition of new motifs so that a splendid renaissance resulted in the 11th and 12th centuries. While much of this is the domain of the art historian it is also that of the archaeologist, whose methods enable style sequence to be fitted to a chronological framework, and whose excavations help to provide fixed dating points and also yield a picture of the everyday life. The field monuments of all types and periods—megalithic (great stone) tombs, burial mounds, open or defended habitation sites, monastic remains—are to be found in remarkable profusion, and excavations of these are yielding profitable results. Methodical excavations in Ireland on an adequate scale were rare prior to the 1930's. In 1932 a five-year program was initiated by the Harvard Archaeological Mission to Ireland, and from 1934 onwards Irish archaeologists were able to excavate important sites with the aid of state grants. These activities have resulted in a changed picture of several periods and aspects of Irish archaeology, but an immense amount remains to be done—on whole classes of monuments in some cases, and to fill the gaps in our knowledge of others.

Mesolithic Period.—Attempts to indicate a Palaeolithic occupation of Ireland must be regarded as disproved or dismissed for lack of proof. Kilgreany cave, claimed by the Bristol Spelaeological Society in 1928 to show Palaeolithic habitation, was re-excavated by the Harvard Mission in 1934, and the earliest evidence of human activity there was found to be Neolithic. Implements of limestone found on the Sligo coast and held to be Palaeolithic (Mousterian) led to a prolonged controversy, but those found *in situ* were not implements, and those which are admitted to have been humanly manufactured were not *in situ* and are therefore of doubtful date. Geologically, Palaeolithic occupation of Ireland is not impossible, as clear evidence of mild interglacial periods has been found. One of the difficulties of the recognition of Palaeolithic industries is the limitation of abundant flint supply to the northeastern corner of the country, and industries of other materials are less easy to recognize.

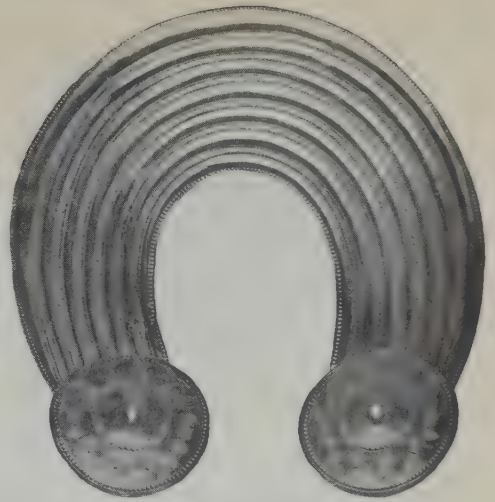
Some of the large flint implements from the northeast have also been claimed to be Palaeolithic, but are now established as belonging to the Mesolithic cultures—which are the earliest definite evidence of a colonization of Ireland. These cultures, associated with the postglacial transgression of the sea which resulted in the 25-foot Raised Beach, have been divided into two phases, Larnian I and Larnian II (named from the site at Larne, County Antrim), and are regarded as being in large measure derived from the Upper Palaeolithic (Creswellian) of Britain. The Larnian is mainly represented around the coast of Antrim and Down, but work since 1946 has shown that it extended much further south—to the coast of Louth and Dublin.

Neolithic.—The vast quantities of flint implements which are the remains of the Larnian culture represent a food-gathering people, and their economy persists in certain manifestations of the Neolithic—though essentially the latter marks the introduction of agriculture and the keeping of domestic animals. On the River Bann, hearths sealed in the diatomite clay are believed to be associated with fishing and the drying of fish, and have yielded Neolithic pottery and pointed flint implements (Bann flakes) which are the

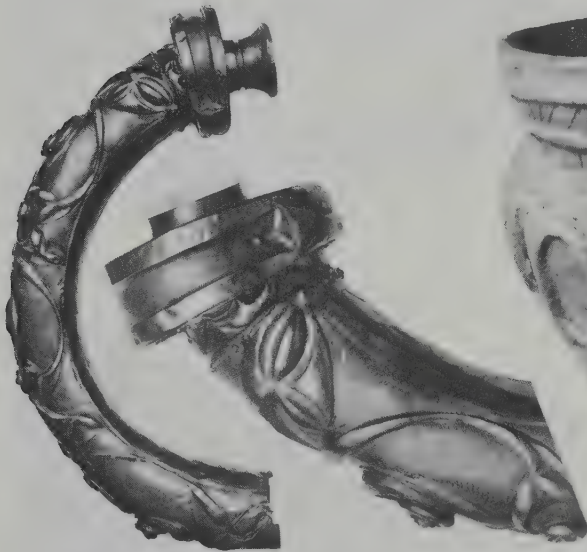
IRISH ARCHAEOLOGY



Gold lunula belonging to the Early Bronze Age.



Gold gorget. Late Bronze Age.



Gold collar and detail. Early Iron Age.



Burial urn of "encrusted urn" type. Late Bronze Age.



Ornamented stone, an example of megalithic art, excavated in 1950.

IRISH ARCHAEOLOGY



Bronze cauldron discovered at Castlederg. Late Bronze Age.



"Food vessel," a well-ornamented specimen, found with burial, 1950. Middle Bronze Age



View of one of the burial mounds, unexcavated, on the Boyne River. Probably Bronze Age.



St. Kevin's Church and round tower, Early Christian monastic ruins, in the Vale of Glendalough.

Photo (top left) © National Museum, Dublin; (bottom) courtesy Irish Tourist Association; (others) courtesy Seán P. Ó Ríordáin

development of flints of the preceding Larnian cultures. Similarly, the settlements on the sandhills presumably represent seasonal activities, and in them have been found Neolithic pottery (and also later material). A more settled economy is attested by the discovery of Neolithic habitation sites at Lough Gur, County Limerick. The first of these sites was discovered in 1939, and a series of excavations was conducted on them during the 1940's. The importance of the Lough Gur evidence is the finding there of Neolithic (and Bronze Age) houses—round and rectangular in plan. The inhabitants depended largely for their sustenance on cattle-raising and to some extent on small scale agriculture. A remarkable site at Lyles Hill, near Belfast, consists of a bank enclosing an area of more than 12 acres, at the center of which is a cairn (mound of stones) covering a cist grave. The bank and the layer under the cairn contained immense quantities of Neolithic pottery sherds. The Neolithic period saw the introduction of the custom of building megalithic tombs. These tombs are of various classes in Ireland and, on the available evidence, the earliest type appears to be the so-called "horned cairn," in many examples of which pottery and other grave furniture (leaf-shaped flint arrowheads) of Neolithic type have been found. These graves consist essentially of long galleries of upright stones originally roofed with slabs and divided into a series of compartments by pairs of jamb stones. The front of the tomb is distinguished by a crescentic façade, sometimes of imposing proportions. The burials are usually by cremation. These tombs are found in the northern half of the country; their distribution extends from Carlingford Lough, on the east coast, to County Sligo, on the west. Related to them are more elaborate structures ("lobster-claw cairns"), found in Sligo, Mayo, and Donegal, on the northwest. They consist of an open circular or oval court surrounded by uprights and a series of segmented galleries which are entered from the court.

Other Neolithic burials of nonmegalithic type include burials (cremated and inhumed) in stone cists, with or without mounds, and in ring-barrows (very low mounds with surrounding ditch and bank).

The pottery gives some indication of cultural connections—with the British Neolithic A (Windmill Hill), which is part of the western group of European ceramics, and with the Neolithic B culture, whose roots are in the Baltic area. The Windmill Hill type of pottery in Ireland is much more widespread than is the Neolithic B, but shows such local developments as heavy and exaggerated rims with ornament. As well as these round-based vessels, a heavy, coarse, flat-based ware occurs which has affinities with the "grooved" ware of Britain (as at Scara Brae, in Scotland) and perhaps ultimately with the Horgen ware of Switzerland and the French (Seine-Oise-Marne) gallery graves. This pottery lasts on into Bronze Age times and provides one of the roots from which the cinerary urn develops.

Bronze Age.—The Bronze Age in Ireland began soon after 2000 B.C., and the preceding Neolithic appears to have provided a short introduction (perhaps of only a few centuries duration) which overlapped with the Bronze Age. In the Neolithic, however, the foundations for the succeeding culture were laid, and the same sites (for example, those at Lough Gur) continued to

be inhabited. Ireland's importance in the Bronze Age was doubtless due as much to the development of the farming economy introduced in Neolithic times (and for which so much of the land was eminently suitable) as to the mineral deposits which the primitive metallurgists exploited. Gold was obtained from the Wicklow area, and possibly elsewhere. Copper mines which were worked in ancient times are known in Waterford, Cork, and Kerry. It is uncertain how much of this ancient working is genuinely prehistoric, but some of the mines (Mount Gabriel, County Cork) show significant similarity with the Bronze Age mines of the Austrian Tyrol.

In the Early Bronze Age Ireland produced certain metal types which are either Irish developments or distinctive variants of those known elsewhere and, because of their distinctiveness, these can be traced outside of the country, thus giving evidence of the role of Ireland in the general development of early metal-working. Among the Irish exports are flat axes (at first of copper, then of bronze, some with characteristic ornament), halberds (blades which are mounted at right angles to the shaft), gold lunulae (crescentic neck ornaments), and gold disks (so-called "sun disks"). The export routes of these commodities, or perhaps the routes followed by craftsmen, can be traced across Britain and to northern and western Europe, on the evidence of objects which are either actual exports or local copies.

The vigorous Irish Early Bronze Age was an amalgam of developments from the Neolithic together with influences from different sources. The beaker folk (known from their special type of pottery vessels), who spread through Europe from the Iberian peninsula, were formerly thought to have had little influence in Ireland. Since the 1930's, however, their pottery has been found in many megalithic tombs of the gallery grave class, in the sandhills, and in the Lough Gur area in considerable quantity—on habitation, burial, and ritual sites. The beakers belong in part to the international type (with S-profile), in part to the special type (A—beakers) developed in Britain.

Gold lunulae found in the Iberian Peninsula are a backwash along a route which brought many influences to Ireland—the origin of the lunula, the idea of the halberd, flint javelin heads polished on both faces. The splendid "passage graves" (megalithic tombs consisting of a chamber reached by a long passage—the whole covered by a great mound) provide the most spectacular result of Iberian influence. Some examples are of enormous size—Newgrange, Dowth, and Knowth, on the Boyne, cover each an acre in area. They tend to group in cemeteries: on the Boyne, County Meath; at Loughcrew, County Meath; at Carrowkeel, in County Sligo; and in a simplified form at Carrowmore in the latter county. Usually placed on hilltops, these tombs are impressive monuments. Some evidence (pottery) is available for their beginnings in the Neolithic, but they belong in the main to the Bronze Age. A feature of the Irish passage graves is the art (magico-religious carvings) on the building stones of such tomb groups (Boyne, Loughcrew, and elsewhere). This art has affinities in Malta, in the southwest of Spain, and even in the Canary Islands; the carvings at Newgrange are paralleled by those in Gavrinis, Brittany. Other rock scribings, not in tombs but on rock surfaces (mainly in the southwest of Ireland),

indicate further connections with Iberia, in this case with Galicia—possibly due to the arrival of early metal-workers from that area.

Gallery graves different in structure from the horned cairns are of two types—the one typical of the northern part of Ireland, the other, very numerous, of the south. Both are dated to the Early Bronze Age by the beaker and other pottery found in them. Independent in origin, but influenced by the ornament of the beakers, is the “food vessel,” so-called because it frequently occurs with burials of unburnt bodies (laid on the side with flexed limbs) and was intended to contain food for the journey to the next life. In its variety of form and ornament the food vessel is an index of the many sources of influence and inspiration which were combined in the Early Bronze Age culture of Ireland. The food vessel is used also with, or to contain, cremated burials; and later, in an enlarged form, it becomes an urn in function and type.

Other structures which may contain burials but which are primarily ritualistic in purpose are the stone circles and related monuments. Though not as impressive as the British “henges” (Stonehenge, Woodhenge, and others) they are varied and numerous in Ireland. Because of their ritual use, lack of finds makes them difficult to date, but one at Grange, near Lough Gur (possibly the finest, consisting of a ring of great uprights placed inside an earthen bank), is securely dated to Early Bronze Age times. A large enclosure with standing stone and grave at the center, surrounded by bank and fosse, at Furness, County Kildare, is similarly dated.

Middle Bronze.—The Middle Bronze Age is a continuation and development of the Early Bronze Age. Known metal forms persist or evolve—the knife-dagger grows into the large dagger and the rapier. A rapier found at Lissan, County Derry, 30 inches in length, is one of the most graceful examples of prehistoric bronze casting. The bronze flat axe is now provided with side flanges and stop ridges, and becomes the “palstave.” Native type spearheads with loops for attachment to the shaft are influenced by the Continental riveted type, and hybrid forms result. Work in bar gold tends to replace the products of sheet gold of earlier times, and twisted gold torques are used as neck ornaments or perhaps, in the case of the great examples found in Tara, as waist ornaments.

Late Bronze.—The Late Bronze Age, which began sometime after 1000 B.C., is characterized by a great increase in the amount and variety of the equipment. The quantity of bronze and gold of Late Bronze Age date in museums is very large, and hoards (associated finds of objects) are a feature of this period. The new metal types—leaf-shaped swords, socketed axes, trumpets, buckets, cauldrons, gold gorgets (neck ornaments), and many others—are not a development of Middle Bronze Age examples, but represent new cultural influences from different sources. How far these are the result of actual invasion, and how far it is justifiable to connect them with the introduction of the Celtic language, are matters of speculation and controversy. The numerous innovations, however, did not cause Ireland to lose her initiative. Some of the gold ornaments are peculiar to the country, others, and some of the bronzes, are distinctive native adaptations of Continental prototypes. The bronze cauldrons exemplify this; magnificent specimens of

craftsmanship, they are translations into metal of pottery vessels—the Greek *dinos*. They are part of the evidence that Ireland received impulses not only from the northern and western continent but also along the old Mediterranean-Atlantic route.

In the Late Bronze Age there was also cultural continuity from the earlier period. If, as seems likely, the grouping of urn burials in flat cemeteries owes its origin to the Continental urn-field cultures, the parallel development of cairns with numerous graves (multiple-cist cairns) must be ascribed to a development from the megalithic tombs. A group of urn burials found in a “ring fort” at Cush, County Limerick, is of importance for the dating of such forts, of which there are thousands in Ireland. Usually circular enclosures (known in Irish as *rath*, *lios*, etc.), with one or more banks and ditches, they provided protection for the habitations built within them. The Cush example had been deserted as a habitation site before the burials were inserted in it. It therefore predated the Late Bronze Age burials, and we have hints on other sites of even earlier beginnings for this class of structure. Accompanying many of these forts, and sometimes built independently of them, are souterrains—underground structures which served as places of refuge and for storage. Crannogs (artificial islands in bogs and marshes), built for the protection of their inhabitants, originated in lakeside settlements in Neolithic times. A small example at RathJordan, County Limerick, belongs to the Early Bronze Age, and a larger specimen at Knockalappa, County Clare, is dated to the Late Bronze Age—Early Iron Age transition.

Early Iron Age.—Several factors make the Early Iron Age the most unsatisfactory period in Irish archaeology. The time of its introduction is difficult to define because of the vigor of the overlapping Late Bronze Age; at Knockalappa, for instance, pottery similar to British Iron Age A accompanied Bronze Age equipment—the leaf-shaped sword, gouge, and sunflower pin. The absence of a Roman invasion means that the Iron Age is regarded as extending to the 5th century, but without precise chronological fixed points. Yet this period is important historically because it is reflected in the great saga literature (the *Cú Chulainn* and the *Finn Cycles*), and it is the time when the notable early historical sites achieved importance. But none of these sites—Tara, Cruachain, Emain, Tlachtga, to name but a few—has been yet excavated. Their investigation should shed much light on an obscure phase.

The 1st century B.C. and the 1st century A.D. see the establishment in Ireland of an Iron Age culture definite in character though limited in distribution and comparatively meager in the amount of material available. The crannog at Lisnacroggher, County Antrim (unfortunately, not scientifically excavated), yielded amongst other objects sword scabbards with curvilinear ornament related to the Iron Age B culture of Britain and ultimately to the *La Tène* of the Continent. The ornament on the scabbards, in common with much of the contemporary Irish Iron Age material, finds its source of inspiration in Britain—particularly North Britain. The development in Ireland is, however, distinctive, and several types are not paralleled outside the country. The outline of the objects and the ornament they bear show a taste for curved forms (in Continental origin, a geometric treatment of vegetal designs)

which later plays so important a part in Irish art development. Brooches, pins, trumpet ends, horse bits of bronze, and inscribed bone flakes (these last found in a passage-grave at Louchcrew), all bear this ornament. Related motives are to be found on stone—at Killycluggin, County Cavan, Castlestrange, County Roscommon, and Turoe, County Galway—on monuments, for which direct Continental prototypes (Brittany) must be sought.

Roman Influence.—Though Ireland lay outside the sphere of Roman conquest, the Roman domination of Britain was bound to have influences on the neighboring island—as did also, in some measure, the extension of Roman power to the shores of Gaul. Roman objects are of sporadic occurrence in Ireland and probably arrived in various ways—by barter, in the possession of refugees from Roman power, and by loot. They belong mainly to two groups. The one, late 1st and early 2nd century A.D., probably reflects unsettled conditions consequent on the imposition of Roman rule in Britain; with these Roman objects native British products were introduced—as in the find of Lambay Island, County Dublin. The second group, of the late 4th and early 5th century, came in as loot brought by Irish raiders who descended on Roman territory when the imperial power was breaking; the objects thus acquired (silver plate, ingots, and coins) were of less importance than were the incidental contacts which resulted in the acquisition of techniques that were added to the repertoire of the native craftsmen. During the Roman period in Britain the Irish artists continued to develop the curvilinear ornament of La Tène ancestry, and applied it now to splendid *repoussé* work in bronze and gold—on gold collars (as from Broughter, County Derry, and Clonmacnoise, County Offaly), on enigmatical bronze disks, and, in a delicate form of cast ornament, on cone-shaped horns from crowns or helmets. But by the end of the Roman period they added millefiori work (the use of multicolored glass rods), niello, and filigree.

The great bank and ditch known as the "Black Pig's Dyke," which runs between County Armagh and County Donegal, is said to have been inspired by the Roman Wall across Britain, though it could hardly have been successfully manned in a military sense and it must have been no more than a precaution against cattle raiding. Great hill-forts, which are a feature of the pre-Roman Iron Age in Britain, are rare in Ireland, but this form of defensive structure occurs in a modified form on some of the royal sites (Tara, Emain, Ailenn) and elsewhere. One, excavated in 1949, at Freestone Hill, County Kilkenny, is dated to the 4th century. Meanwhile, many ring-forts and crannogs must have been in occupation at this time, and also at least a proportion of the numerous promontory forts which are found on the coast. Some examples excavated in County Cork during 1949–1950 did not yield datable finds but showed structural features similar to those in Cornish and Breton promontory forts.

Early Christian Period.—The term "Early Christian" is used for the period from the introduction of Christianity in the 5th century to the late 12th century. The stressing of the *Christian* aspect is justified by the fundamental changes which the Christian faith brought about in the pattern of life and consequently in the archaeological record.

Forts, crannogs, and houses similar to those of pre-Christian times continued to be built and occupied. However, as well as the secular sites, remains from this period include churches (or church sites, where scant remains or tradition mark the places from which wooden or even stone buildings have vanished), monasteries, great and small (and their accompanying memorials—grave slabs, inscribed pillar-stones, crosses), as well as round towers (built largely as refuges from Viking raids) and the dwelling cells of the monks. The monasteries were in some cases modeled on the secular forts—with enclosing bank or wall. What astonishes is their prodigious number—not all datable, and certainly not all of contemporary foundation; but it is clear that already, in the 5th century, ecclesiastical establishments began to be built plentifully throughout the land, and in the 6th the foundation of the great monasteries began—with that of St. Enda of Aran as the first example. Little remains of the buildings of the most famous monasteries, but a site like that on the Great Skellig (off the coast of Kerry)—little more than a bare rock in the ocean—indicates the essentials of the early monasteries. Being in a treeless spot, the buildings were entirely of stone. Small churches and a collection of beehive cells are a reflex of the type of monasticism—eremitical, ascetic to an extreme degree—which produced a multiplicity of buildings instead of the single building of Continental monasticism as established by the Benedictines.

The curvilinear art of the Iron Age survives on pins (hand-pins), brooches (so-called latches), and other minor objects, frequently now with the addition of enamel. But it is Christianized by its use on the monastic sites—on stones with ornament alone, or ornament combined with crosses of various forms. The designs develop in complexity, new motifs such as interlacing and figure representation are added, and the magnificent high crosses of stone result—mainly with geometric ornament in the 8th century, with scripture subjects in the 9th and 10th, and again with ornamental carvings in the 11th and 12th. The illumination of manuscripts of the Gospels gave a new medium for the artists of the monasteries. Examples are the books of Durrow (7th century), Lindisfarne (early 8th), and Kells, the greatest (early 9th). Lindisfarne is but one of the foundations which resulted from Irish missionary activity in Britain and the Continent. The minute complexity of the illuminators' work reacts on the metal workers and enameleurs who originally inspired it, and such treasures as the *Ardagh Chalice* and the *Tara Brooch* are achieved.

Viking Influences.—Relics of the Viking invasions which began in the late 8th century are strangely limited—one large cemetery at Dublin, and sporadic finds through the country. The loot of the raiders carried back to Norway—ornaments, reliquaries, church lamps—is important archaeologically because it is found in dated contexts—mainly in graves of the 9th century—and fills many of the gaps in the Irish record. Irish motifs influenced Scandinavian art and, notwithstanding the shock of the invasion, Irish craftsmen continued to work. The high crosses were still carved, metalwork continued, though the great 8th century overshadows the two that follow and make it difficult to recognize their products. Paradoxically, it is not until after the breaking of the Viking power at Clontarf that the Irish

artist accepted northern motifs and incorporated them in his repertoire, blending them, however, in a manner which was distinctly his own.

Meanwhile church building had developed. The use of mortar (perhaps introduced in the 7th century) made larger structures possible; the roof, formerly of dry-stone corbels, was elaborated, and ornament was used on doors, chancel arches, and windows. But even the beautiful Romanesque churches, with interesting variety of ornament, are small buildings not comparable to those of the Continent. The coming of the Cistercian builders of great abbeys, in the early 12th century, is the herald of the end of the era.

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IRISH ART AND ARCHITECTURE.

Ireland's position as an art and architectural country is conditioned by the fact that it is situated at the extreme northwest angle of Europe, far from the center of eastern Mediterranean civilization and thus destined to receive its art impulses at long remove. Insularity retarded invasion in bulk and then insured long periods of incubation so that at well-defined moments the elaborated ideas flowed back into Europe, as for example: the gold trade of the second millennium B.C.; the medieval missionary movement (650 A.D. onwards); or the late 18th century leavening of European literature into Romanticism through Celtic, specifically the Ossianic, epic. The antique Irish ringed cross, revived by 19th-century patriotism, became popular in many places as a memorial of the valorous dead from 1914 onwards.

Iberian explorers of 2,000 B.C. or so opened up the country when they discovered gold in quantity in the streams of the Wicklow Hills just south of Dublin, establishing a tradition of gold-work which was maintained up to the Anglo-Norman Conquest of the 12th century. Late Celtic settlers coming mainly by way of northern Britain from Europe about 250 B.C. onwards brought in the first developed ornamental style, a style destined to reach new heights in the Christian era from 450 A.D.: it continued logically with Norse admixture till the Conquest, a long drawn-out business which destroyed the native development without creating new styles. However, within the core of the English settlement around Dublin in the 18th century a new nationalism developed, enriching the country economically and making Dublin one of the art cities of Europe. After an awkward pause in the middle of the 19th century this renewed itself until fused with Gaelicism and, influenced by native epic, a new art urge appeared; Ireland, which tends to develop along normal European lines, is still individualistic and not entirely uninfluenced by American attitudes.

Dublin remains the art capital and possesses the principal art school (National College of Art), housed indifferently but staffed by a brilliant group of art professors which includes lead-

ing painters like Seán Keating, president of the Hibernian Academy, and Maurice MacGonigal, its curator. The Hibernian Academy, founded in 1820 in succession to the Society of Artists, aims to include in its membership established painters; it holds an annual exhibition available to the public for a month. Adjoining the college is the National Gallery, opened in 1854, regarded as one of the best of the smaller European galleries, a position due to its second director, Henry F. Doyle (1869-1892).

In the same area are the National Library, with a large print collection, and the National Museum, which includes valuable archaeological and decorative art collections offering a wide selection of exhibits to the craftsman desiring foreign models or seeking to emulate the masterpieces of the Celtic and medieval periods in Ireland.

Dublin has also a good gallery of modern painting (Charlemont House), due ultimately to Sir Hugh Lane (drowned in the *Titanic* disaster in 1912) which was intended to house a large collection of modern French masters; owing to a faulty will, these have been retained in London. Belfast, capital of Northern Ireland, has a good combined museum and gallery and an awakening art school; other provincial Irish towns since 1930 have been founding the nuclei of museums and galleries, the permanence and eventual value of which cannot yet be assessed. An Art Act intended to forward organization and development became law in 1951.

Additional annual art functions like the Oir-eachtas Art Exhibition and the Living Art Exhibition give scope to numerous artists having different objectives, while the art centers of the Dublin Painters (7 Stephen's Green) and the Waddington and Dawson galleries, are rarely free of special exhibitions which sometimes include works by noted foreign painters and sculptors, including extremists of various kinds.

Iberian Art.—To the early Iberian settlers and gold seekers in Ireland coming from Spain and Portugal by way of western France and Brittany the first flashes of a definitive art may be attributed, finding its expression in the decorative or symbolic treatment of many of the great stones and flags which form their chamber-and-passage tombs. These are chiefly situated in the Boyne Valley (an Irish "Valley of the Kings") and the adjacent Loughcrew Hills, all in the ancient central kingdom of Meath. It is a residual art long removed from the original representations of goddesses and the like. The same general age, just after 2000 B.C., produced a more systematic style, geometrical in character, applied to gold crescentic neck-ornament, bronze axes, and earthenware. Throughout the Bronze Age proper, decoration of a related character is the sole evidence of artistic expression, borne out by superb series of gold ornaments, gradually becoming more sophisticated as the age advanced; the heavy gold collars of the close of the period reproduce leather armor, bronze neck-guard and shield details, evidence of a new art influence involving northwest Central Europe.

Early Celtic Art.—With the coming of Marnian Celts a more elaborate and still more abstract decorative style was introduced linking Ireland through northern Britain with north-eastern France and Switzerland, where the style achieved a name, La Tène, a noted site on the Lake of Neuchâtel. It became the leading Irish

style for centuries, playing a notable part in the efflorescence of culture between 750 and 1050 A.D. and strongly influencing modern Irish ideas. It is in essentials the Greek palmette reduced to graceful groups of spirals or scrolls ending in or uniting lobes, either flat or in relief; these latter may meet to form "trumpet ends" or lens-forms disposed throughout the ornament. The classical monument of this art, which may date 250 B.C., is the western Irish *Turoe Stone*, a low rounded pillar over which is cast, like a chasuble, two fields of ornament finished at the end with a Wall-of-Troy or simple fret ornament; it is sculptured in low relief carving, the field being pocked to give emphasis to the pattern, and the whole may have been covered with a thin plating of gold for which treatment there is both literary and archaeological evidence in connection with other cult objects. In the main, however, the art is preserved or recorded as the main decoration of metal wares, brooches, scabbards, chariot- and house-fittings, mirrors, and the like. Certain unexplained bronze disks in which stylized human faces are worked out in embossed *La Tène* ornament, and a cylindrical gold torque of great magnificence found on the shore of Lough Foyle, Northern Ireland, are notable masterpieces of the metalworker's art. Actual sculptures in the round exist, but they share the continental Celtic sculptor's lack of appreciation for style and anatomy.

Christian Period.—The succeeding epoch, 250–550 A.D., one of political disturbance, is rather arid of art achievement, but with the coming of Christianity in the 5th century and the growth of flourishing monasteries this condition was gradually replaced by a fine flowering of a native art inspiration, the materials selected helping to mark out the periods of the development; that of the great illuminated manuscripts, that of the tall, free-standing high-crosses and that of the metal shrines, all of course overlapping in one way or another. A faded Celtic ornamental style so-called *Ultimate La Tène*, occurs in bronzes, etc., and, reaching into the earliest mss., fore-shadows the astonishing revival of Celticism of the succeeding age.

Illumination.—Irish illumination as such is incomprehensible apart from the missions sent forth by St. Columba (Columcille) of Derry, who died in 597 A.D., dominating northern England and much of Scotland. In the former area, surviving Celtic ornament might be found alongside animal scrolls introduced by the Angles and other Germanic tribes. Rich Byzantine manuscripts were introduced from Italy by St. Augustine of Canterbury, in 596, and by Benedict Biscop of Wearmouth and Jarrow, in northern England, about 675. The Irish style came therefore to be compact of Celtic, Germanic, and Byzantine motives in an essentially Byzantine framework. The three principal monuments of this distinctive and impressive art are the *Book of Durrow* (County Kildare), the *Book of Lindisfarne* (off the English northwest coast, a monastery founded for St. Aidan and a party of Irish monks by St. Oswald, Anglian king or Northumbrian), and the *Book of Kells* (County Meath); all three books belonged to abbeys under the influence of Iona (off the southwest Scottish coast) and, of course, the Columban Rule. It can be presumed that the three works date to about 700–775,* and many other manuscripts bear

the same imprimatur of Celticism—for example, the *St. Gall Gospels*, in Switzerland. *Lindisfarne*, by reason of its delicacy of treatment, is nearest the supposed model; *Durrow*, in its relative simplicity, appears as a "try-out"; while *Kells*, despite the grave stylization of the portrait element, is, by its wealth of coloring, the extraordinary fineness of its interlacement, its luxuriant fancy, and the numerous small and quite irrelevant colored drawings, the outstanding work of the group and epoch. The *Codex Amiatinus*, in the Laurentian Library at Florence, is reasonably regarded as best illustrating the original foreign exemplar or exemplars. The book-contents, apart from text, are mainly pages given up to portraits of Christ, the Virgin, the Evangelists, the Symbols of the Evangelists, the Christ sign in Greek (XP) which is the tour de force of these manuscripts, and columnar arcades enclosing the Eusebian canons (gospel cross references); some pages are all ornament: such pages may now be regarded as originating in earlier book-cover and colophon-page designs, the East Mediterranean source of which is already known. Despite the seeming disorder of the decoration—spirals, inter-lacements, and frets—a rigorous panel arrangement dominates, and the presence of the Byzantine mosaicist and marbleworker in spirit is unmistakable. A special tribute has to be paid to the fine naturalistic birds which characterize *Lindisfarne*.

Sculptured Crosses.—Peace essential for such prolonged and delicate labors disappeared with the Viking raids, about 850 onwards, on the Irish and British coasts, especially those about the North Channel. Irish genius now expressed itself in superb high-crosses which are in effect the projection of manuscript ideas in stone, even as to form, namely, a combination of the Greek and Latin crosses with the normally surrounding circle of the former set squarely at the junction of the arms of the cross. Their main date is perhaps 800–950 A.D., with an extension to the 12th for some atypical varieties. Byzantine inspiration furnished northern Britain with two tall stone crosses, those of Bewcastle and Ruthwell, which provided the general idea for the intense Irish development; they clearly derive from the *Cross of Constantine* at Jerusalem, adjusted to an Anglo-Saxon carved-timber tradition. Columban influence stands behind the movement. *Kells* (County Meath) has thus a number of exemplars and *Durrow* has one notable cross, but the finest examples are those of *Monasterboice* (County Louth) and *Clonmacnoise* (County Offaly). Armagh can be taken as the center point of the whole northern series. An early group at Ahenny (County Carlow) is notable for its almost wholly ornamental character; and in one the wedge-shaped foot, as if pared for fitting to its pyramidal base, indicates that these lofty monuments derive in part from a long line of carved timber monuments of which no exemplar survives. The leading groups, scripture-crosses as they were called, show numerous panels illustrating parallel scenes from the Old and New Testaments but with free use of purely decorative items derived from the manuscripts. Often the cap is of house-form and illustrates not only contemporary architecture but shrines of the house type. The importance of these crosses in the history of European sculpture is the essential theme of the works on the subject by Arthur Kingsley Porter (1883–1933).

* These dates are controversial. See IRISH ARCHAEOLOGY—Early Christian Period.

Art Metalwork.—Celtic craftsmanship which left a permanent tradition of fine metalwork behind it was strengthened by the importation of workers with a new style by St. Patrick and other missionaries. The typically Irish penannular brooch, a long pin with a large ring and a derivative of the Roman buckle, occupies an important place in this phase of Irish art history; in due course the ring and head were flattened and the terminals formerly turned back, then flattened, and finally unified, providing three main surfaces which came to be decorated in the richest manner possible but in a style closely related to that of the illuminated manuscripts and the high-crosses. The high peak of this series is the *Tara Brooch*, found on the east coast of Louth; an attached silver chain of fine wire mesh shows that it was one of a pair. This gem of western European art is made the recipient of numerous techniques; gilding, niello, chasing, enameling, and jewel-cutting, the last mentioned, small human heads of garnet(?) at the hinge joining the chain to the ring. This ring is a near parallel in design to the ring of the principal Irish high-cross (Monasterboice), evidence of interinfluence. The second primary jewel of the same epoch is the *Ardagh Chalice* (County Limerick) a minstral two-handled chalice with deep bowl, a very short stem, and a domical base with flattened foot; the handles, highly ornate in character and having close relation with brooch details, are embellished with red and deep blue enamel bosses. A typical manuscript band of ornament, gold panels separated by enamel bosses, surrounds the cup; underneath this are the names of the Apostles (including Paul), emblematic of the Last Supper, Christ being represented by ornamental medallions of gold spirals in a Greek cross setting on either side of the cup. The interior of the base, which could be observed when lifted up by the priest, is a crystal surrounded by several zones of gold paneling set off with amber (now largely missing). The piece is rightly regarded as the outstanding jewel of its kind for the age. The writer dates these two ornaments on the basis of accumulated techniques to about 950–1000, but a date two centuries earlier is often mentioned; and a similar diversity of view may arise regarding the latest jewel added to this short series—a reliquary belt composed of hinged and curved sections with paneled ornaments, the *Moylough Belt* (County Galway), a late discovery: some of the ornaments simulate high-cross heads of a type usually assigned to the 11th century, for example, that of Drumcliffe, County Sligo.

Eleventh- and 12th-century metalwork is illustrated by a number of elaborate book-shrines, bell-shrines, house-shrines, and crozier-shrines, mostly of a high standard of workmanship but signalized by the intrusion of Viking ornament and a progressive coarsening of detail. *St. Patrick's Bell* (5th century) and its silver shrine (about 1100 A.D.) constitute outstanding Irish insignia. The latter is a tabernacle form, the front decorated with panels of coarse gold spirals in a book-cover setout; the back is a perforated silver panel with swastika motive, based on Continental transennae, or shrine-panels in carved stone, a constant feature of Irish metal shrines; the narrow sides are filled with a coarse wire scrolling, and have rings for suspension. This epoch ends with two notable monuments: the ark-shaped processional *Shrine of St. Man-*

chan (Boher, County Offaly), having an elaborate array of stylized figures, the saint, and his community; and the processional *Cross of Cong* (County Galway), a shrine made for a portion of the True Cross. The general design of the latter is that of the *Constantine Cross*, with scalloped sides, the front being filled with gilt panels of animal-style interlacement and a crystal at the center. The very tall high-cross of Tuam, which is decorated in a low-relief interlacement in the same style, brings the main Irish development to a logical close. Shortly after these objects were made the Anglo-Norman conquest of Ireland began (1169) and a long period of artistic chaos ensued.

Pre-Conquest Architecture.—The architecture of the pre-Conquest period is divided between two very different modes based respectively on wicker construction and stone corbelled work, assimilated as to style to timber forms now no longer existing. Western Ireland, because of its treeless character and the effective recourse to dry-stone walling, is remarkable for a series of ancient fortifications. The chief examples of these are the remote hill forts of Staigue (County Kerry) and Aileach (County Derry), and the elaborate promontory forts of the Aran Islands, notably that of Dun Aonghusa, all belonging to the Celtic epoch. Even in the beginning of the metal age, well-built tombs with entrance passage and corbel-built chamber characterize the Boyne Valley and other cemeteries. Details of wicker construction are preserved in the Celtic romances, and advert to both circular and rectangular structures. It is the corner-post and gable elements of the latter which contribute leading features to the first stone churches (these often of very limited size). The circular form continued in earliest Christian times as clochain, or beehive cells, for hermits dwelling along the west coast—for example, the laura on Skellig Michael, County Kerry.

From these, an oblong oratory type evolved, still corbelled (such as that at Gallerus, County Kerry). Soon small oratories with erect walls appear (Mac Dara's, County Galway), but the corbelled tradition continued in roof construction right up to the climax of Irish pre-Conquest building, as in Crimmac's Chapel. This is a unique Romanesque gem of the 12th century, replete with twin square towers (implying Rhenish influences), recessed entrance, and tympanum, and a free use of arcades with painted designs within for surface decoration. The features of this insular development are: battered (sloping) walls, the batter lessening as time advanced, sloping door and window jambs parallel to the wall batter, corner antae (piers) on the east and west walls, and projecting square moldings on the gables, the latter details being pictures in stone of features in contemporary timber construction; the gable was topped with a winged finial, itself a timber derivative. Doors were mainly square-headed, with a relieving slab above, usually bearing the Christ sign (Greek cross) or, as at Maghera (County Derry), a sculptured Crucifixion in the style of the high-crosses. From 1000 A.D. onwards, normal arched doors, often deeply recessed with zigzag and human-head ornament, and even interlaced designs thinly sculptured, become common: Killeslin, County Carlow, is a fine example. Chancel arches were similarly treated. The evolution of plan was equally deliberate, the small oratory becoming

the sanctuary in a two-piece plan of which the nave was perhaps three times its area (as at Rahan, County Offaly). No transepts figure in this development, and square apses, where they occur, as in the next epoch, are the rule.

The principal centers for examples of these types are the monastic settlements of Clonmacnoise (County Offaly) and Glendalough, (County Wicklow). Columba's House at Kells (County Meath) illustrates the growth of the clochan or beehive cells through much straining to be the upper chamber or priest's room over a tiny oratory. With the assaults of the Vikings, from the 9th century onward, monasteries were more carefully defended. Thence evolved the tall round-tower, so characteristic of the Irish countryside, consisting of a cylindrical tower with conical stone roof; the door was pitched high above the ground, and string courses carried five or six floors, lighted by slit windows, often four in number, at the top. Their Irish name, *cloig-theach*, indicates that they were regarded as belfries, but they also served as refuges and treasuries. Their period is between 900 and 1050. The finest example, with external string courses, is that of Ardmore (County Waterford). That at Glendalough gives centrality to an extensive monastic settlement. As in other structures, the towers are slightly battered (inclined), that at Ardmore especially so.

Later Developments.—With the introduction of the Cistercian Order by St. Malachy, straight from Clairvaux, France, an end was brought to the traditional modes of the Irish monastery, and with it the native tradition in building. His establishment at Mellifont, in the Boyne Valley, was built in a Late Romanesque manner in 1142, it was followed by others still building when the Anglo-Norman Conquest began. The following centuries are therefore full of building activities. Cathedrals, abbeys, and the like are effectively provincial versions of English and French work, tending in the 15th century to evolve into a subordinate national style; the main feature was a square-tower crowning the transept crossing and the old square apse. Christ Church Cathedral, Dublin, bears ample evidence of its relation to churches of Somersetshire, England, itself not a strong building center. The suppression of the abbeys in the 16th century left them without successors for a long time to come. Notable remains survive at Holy Cross, County Tipperary, and Cong, County Galway. Military architecture began in 1170 A.D. with the erection over a wide area of eastern Ireland of timber castles surmounting high mottes (eminences) and surrounded by baileys (outer walls) and palisades at ground level; it ended with stoutly built stone castles, shadows in plan and general character of Anglo-Norman building in England. The "frontier" citadel of Trim, County Meath, is a good example of military architecture. Abbeys were often castellated, and the frequent presence of battlement motives in quite late church building no doubt re-echoes this earlier age of strife.

With the year 1700 and the absence of any serious threat of an Irish recovery, nationalism came to roost in the English Pale itself and a movement of city embellishment appeared especially in Dublin. By the end of the century numerous public buildings of neoclassic design had sprung up at artistically strategic points in the city complex, mostly associated with the architect James Gandon: Parliament House, the Four Courts Buildings, the Custom House, King's

Inns, and later, in the early 19th century, the General Post Office. The interspaces were filled with good Georgian mansions, many of which boasted superb ceilings and fireplaces. Houses like those of the earl of Charlemont and the duke of Leinster, in neo-Palladian style adjoining fine squares, helped to complete the Dublin architectural scene around 1750. The style, which had many rural triumphs also (like the seat of the Connollys at Castletown and that of the Leinster family at Carton, both in County Kildare, residences of palatial design, extent, and even contents), had sufficient validity to bear translation to colonial America. This further variety of the style is epitomized in the White House, itself built during 1792-1800 by the Irish architect, James Hoban of Kilkenny; the structure has many points in common with Leinster House and the President's House (formerly Vice-regal Lodge), Dublin. Hoban had done much fine work in Carolina before being discovered by Washington, indicating that this fine flowering of American civilization, its Colonial Palladian, can, like much else, have a strong Irish backing. Sculptors now emerged, such as Edward Smith, John Henry Foley, and John Hogan, mostly trained in the Roman school of the time; they began to fill a long vacant gap in Irish art history. A mere handful of wood carvings, some in polychrome and a few recumbent figures of Anglo-Norman grandees, are all that unite the present age with that of the high-crosses in the line of distinguished sculpture.

In the new economic recovery, largely stimulated by the example of the American colonists, the decorative arts began to flourish. Glassmakers from Stourbridge, in England, established in Waterford, at the end of the 18th century, a factory which produced in generous quantity many finely cut forms of domestic glassware, chandeliers, decanters, footed salvers, and the notable salad-bowl forms beloved of collectors. A tapestry school begun near Dublin in the time of Charles II promised remarkable achievements but failed to hold its ground. In Galway, silver almost maintained the traditional link with the past, but in general Irish silver attuned itself to English and French design. An assay office in Dublin ensured high standards not only in metal but technique, and Irish silver is not unreasonably cherished by the collector. The noted *de Burgo-O'Malley Gothic Chalice*, probably made in Galway, indicates that despite unsettled conditions fine aesthetic achievements were possible even in the 15th century.

Minor Arts.—The minor decorative arts like furniture and textiles benefited enormously by the changed conditions: much of the former survives, but owing to the lack of house accounts and illustrated sales lists the art is largely anonymous. On the other hand, the close interest taken by the Dublin Society in linen and cotton print design has left us ample records of the textile industry, though surviving examples, topical or classical figurings for the most part, are very rare. The period of flowering was between 1730 and 1830. Neocolonialism even turned to the native harp and its rich musical tradition; while a personified Hibernia, already on silver-work from 1731 and now a rival to Britannia herself, often became the badge not only of Irish workmanship but of high quality also.

Irish lace (and crochet), because of its international *réclame* and mature excellence, is often

regarded as an old traditional art. In effect, however, it is a 19th-century inspiration which struck surprisingly deep roots, and in a relatively short time it came to equal, if not excel, the products of Brussels and Valenciennes; Limerick and Carrickmacross are the two centers especially associated with the art. While still of interest to the connoisseur, the lacemaking movement has practically disappeared, the victim of a change in fashions.

Ceramics lagged far behind Continental standards. Nevertheless the 18th-century Delamain factory at Dublin held much promise, and the 19th century Beleek factory (County Fermanagh), through its imaginative designs and its unusual mother-of-pearl luster, attracts some tastes and is of interest to American collectors.

Modern Epoch.—The short-lived efflorescence of the latter half of the 18th and early 19th century ended with the Great Famine of 1847. A new trend upwards, terminating in the present republic, then appeared; it was bound up, however, with a reversion to the antique Gaelic background, with its superb epic literature and art. So, from 1890 onwards, there was achieved a new mastery of the Irish consciousness affecting industry, drama, music, and literature. Already a few meritorious painters, like James Barry of Cork (q.v.), a rival of Joshua Reynolds, had demonstrated Irish possibilities. The new wealth of late 18th-century Ireland had given work for many competent portrait painters, later to come, like English painters of the time, under the virile influence of the American painter, Benjamin West (q.v.), president of the Royal Academy, in London. In London at that period was also another American, Gilbert Charles Stuart (q.v.), who, before returning to the United States, dwelt in Dublin and there produced many pictures, including some of the patriotic notabilities of the Irish Parliament; this service was parallel to that which he afterwards rendered the founders of the new republic of the West. The extent to which the Irish painter Nathaniel Hone (1718-1784) may have contributed to the style of these brilliant American painters in the direction of a natural and vital portrayal emancipated from classical and English social conventionalism cannot be overemphasized. Some of the latter's best work is in miniatures, a category in which Charles Robertson (1760-1821) and the more prosaic John Comerford (1770-1782) of Kilkenny also deserve honorable record. The groups just mentioned emphasize the strong forces linking national and artistic growth; however, little divided the artists of this short-lived renaissance in tone from the contemporary English movement, and this is true, of course, of the first painters of free America.

The French movements of the 19th century left Ireland untouched to any serious extent, though the habit of looking to Italy remained constant. The brothers Mulvany, both academic painters, appeared to be on the verge of discovery with their studies of peasant life. Again, the depiction of movement, especially animal movement (which still remains a weak point in Irish painting), received an adequate and, for 19th-century Europe, new inspiration from Michael Angelo Hayes (1820-1877), an interpreter of British military events and Irish genre subjects. Some of his pictures engraved by Rudolph Ackermann (1820-1877), of Düsseldorf and London, acquired wide popularity. James Arthur O'Con-

nor (1792-1841), with his romantic and often moonlit German and Irish landscapes, was, however, no substitute for a Théodore Rousseau or a John Constable—though of sufficient merit to obtain a kind of revival in Ireland about 1940. Daniel Maclise (1806-1870) was certainly a competent painter and of large ideas, though modern taste shows the same disregard for his drama-influenced creations as for those of Lawrence Alma-Tadema: his *Marriage of Strongbow and Eva* (Norman conqueror and daughter of a Leinster king) was long the *pièce de résistance* of the National Gallery of Ireland. We can be thankful, however, for his sympathetic portraits of Thomas Moore, the Irish poet of the early 19th century, and of the English novelists Charles Dickens and Harrison Ainsworth. Ireland became the home of the young English painter, George Chinnery (1774-1825), whose Irish portraits make such a striking contrast to his gracious and much-sought-after portrayals of Chinese and Indian life; he may be quoted as indicating the continuing art life of the Irish capital and its power of attracting genius.

Eventually the appearance at the turn of the century of Walter F. Osborne and Nathaniel Hone, noted landscape painters taught by European experience, indicated lines appropriate to a school not then likely to possess an extensive clientele at home. The great portrait painter, William Orpen, an Irish "Gilbert Stuart," was able to bestride both Ireland and Britain with his lightsome and easy portraiture of interesting personalities. Patrick Tuohy, many of whose paintings are in New York, where he tragically died, might easily have excelled him despite his grimmer handling of reality. Sir John Lavery, a competent society painter whose canvases have enriched the municipal galleries in Dublin and Belfast, and who painted mostly in London, never achieved an Irish vernacular despite valued depictions of Sir Roger Casement and other notable men of the revolution. Irish taste seems to demand a slight cartooning approach, and this is strongly visible in the early work of Jack Yeats, brother of William Butler Yeats, the distinguished poet, in his studies of western peasant life; his later work is indicative of a personality of extraordinary fantasy and dynamic color skill. His popularity and perhaps his status are adumbrated by the fact that a first-day of an exhibition of his works, 21 in all, saw 16 of them sold at a total of £6,000 (Oct. 8, 1951).

The developed Irish school now took shape in the persons of Seán Keating, Seán O'Sullivan, Leo Whelan, and Maurice MacGonigal, influenced by, but by no means following too closely, current European modes: Spain rather than France or Italy attracted them, a throwback to early Iberian sympathies perhaps. The west Irish scene occupied the patternist painter, Paul Henry, while more routine landscape painters like Frank McKelvey and J. Humbert Craig chose the north Irish scene, the former in his later humor clearly deriving some inspiration from the great Corot. The fairy and mythic element found interpretation in the light works of AE (George Russell), the poet, who left no successors: the dream atmosphere of Lady Glenavy's, Patrick Hennessy's, and Cecil Salkeld's studies, the last influenced by Hilaire Degas, is entirely personal to these artists. In Northern Ireland, the distinguished humanist painter, William Connor, has reduced large numbers of agricultural and indus-

trial types to the sympathetic expression of his able canvases. In sculpture there is less to be said: Oliver Sheppard, a robust modeler, has left many pieces which shadow forth ancient epic. Albert Power, most typical Irish sculptor, was a good portraitist and a sympathetic interpreter of children: his fish sculptures in Irish green marbles are special to him. It is usual to swell the tale by including the Irish-Americans, Jerome Connor and Andrew O'Connor, who at an advanced stage in their career resumed their artistic citizenship: both are well known in the United States and are well represented in Irish collections. Augustus Saint-Gaudens (1848-1907), born in Dublin of Franco-Irish parentage and founder of the modern American school of sculpture, can hardly be added to this group. He is, however, represented in the city of his birth by the strongly designed statue in bronze of the Irish tribune, Charles Stewart Parnell (1846-1891), with its striking triangular obelisk.

It is a sign of vitality that a junior school is making its way sunwards: men more sympathetic to the European trend like Fergus Ryan, an urban painter, and Louis Le Brocqy, who has become the *fauve* of a group of which the Northern Irish painter, Daniel O'Neill, may become the leading light. Junior sculptors are Lawrence Campbell, Peter Grant, Miss Hilary Hearne, and Gabriel Hayes, of whom Miss Hearne is the sole modernist, a student of pure form. Rosamond Praeger is a sensitive creator of child studies.

A parallel growth of "Celtic" art marks this new phase and has given us superb *Book of Kells* work, that of Art O Mornachain, and the precious pieces of the metalworker's art by Miss Mia Cranwill—some of them now in San Francisco Cathedral. Medieval Irish art also invaded the goldsmiths' atelier, producing "Celtic" ideas of ornament and even reproductions and adaptations. Enameling, never logically developed in Ireland, found a new expression in the work of Oswald Reeves, mostly subsidiary to metal pieces, but the art failed to maintain itself, in spite of some fine achievements. Greater emphasis may be laid on stained glass of this epoch, whether it be the Romanesque masterpieces of An Tur Gloine (The Glass Tower), the Gothic-Celtic creations of the Clarke Studios, or the frank Renaissance work of Messrs. Earley's workshops, often reminiscent of the glass in Prague Cathedral. Several art guilds—like the Cuala Industries, a Yeatsian foundation, and the notable Dun Emer Guild, noted for superb carpets and embroideries employing pure Celtic design—gave shape and direction to a movement whose outlines have tended in later times to become blurred.

A promising movement to revive Irish Romanesque traditions in architecture naturally accompanied the uprisal, but save for the Honan Hostel chapel, at Cork, and the parish church at Spiddal (County Galway) the movement, especially associated with the name of William A. Scott, has not been intense. The fine Byzantine interior of University College Church, Dublin, has a more magnificent successor in the basilican cathedral of Mullingar, County Westmeath. Romanesque taste, however, survived though in later times contenting itself with Italian hill-country and Spanish-American models and suggestions. The fine 19th-century revival of Gothic produced Killarney Cathedral by A. W. Pugin, founder of the style; the superb twin-towered primatial cathedral in Armagh (architect, J. McCarthy), the

old ecclesiastical capital where St. Patrick established his primitive church buildings in the 5th century, and St. Peter's Church (architect, George C. Ashlin) of the Vincentians, in Dublin.

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IRISH CHURCH HISTORY. The opening date in Irish ecclesiastical history is 431, when Palladius was sent by Pope Celestine I "as their first bishop to the Irish who believed in Christ." By that time the conversion of Gaul was complete and the conversion of Britain far advanced, so that the extension of the Christian faith to Ireland was to be expected. Palladius was not the person through whom this work was destined to be accomplished. It is likely that he died before this task was well begun, for the traditional date of the coming of his successor to Ireland is 432. This Patricius (Patrick) was a Briton of respectable ancestry who had been taken prisoner by Irish raiders at the age of 16 and sold as a slave to a master in County Antrim. After six years he had managed to escape. Soon he felt within himself the stirrings of a missionary vocation. He studied in Gaul as well as in his native Britain, was possibly for a time a monk at Lerins, in the Mediterranean near Cannes, was certainly a cleric attached to some church like Auxerre before the "desire of his soul" could be realized, and he set foot in Ireland at the head of a band of British and Gallic missionaries.

St. Patrick found Ireland almost wholly a pagan country; he left it at his death predominantly a Christian land. This is the evidence of the *Confession*, a short spiritual autobiography penned by him in the evening of his days. It is the evidence also of Irish records, which begin

to take reliable shape precisely at this period. St. Patrick is thus the Apostle of Ireland, and has been honored as such with a devotion for which there are few parallels from the middle of the 5th century down to the present time.

It is obvious that the Apostle would seek to reproduce in Ireland the church organization which he knew so well in Britain and Gaul. In the way of this, however, there were obstacles which it was difficult to overcome. Chief among these was the lack of cities; of places, in other words, where episcopal sees would normally be fixed. Some deviation from the Continental model thus became inevitable. Another peculiarity, which began to appear in St. Patrick's lifetime and gathered momentum, in extraordinary fashion, about the year 520, was the popularity of the monastic ideal. Before the 6th century ended Ireland was dotted with monasteries and smaller religious houses. Most of these were ruled by abbots, who were priests, not bishops. The result was an increase in the prestige of the abbatial position to a point far beyond what St. Patrick had ever foreseen. Abbots came to represent the highest power in the ecclesiastical order, though never equated in dignity with bishops, who in "honour-price" continued to rank with kings.

Saints and Scholars.—The Golden Age of the Irish Church—relatively short, as all periods of unwonted prosperity are wont to be—may be placed within the years 620–740. High idealism and strict observance within the monasteries resulted in profound peace. The monks held themselves aloof, with astonishing success, from the ambitions, jealousies, and quarrels of the secular states. To outside observers Ireland looked an *Insula Sanctorum*—Island of Saints. Thanks again to the ancient Celtic heritage of education, it was taken for granted that the monks should be no less learned than the poets, brehons, and chroniclers of native tradition. Hence every monastery had its school. Classical literature was introduced and cultivated. The works of the fathers and writers of the church were studied. Irish *literati* became skilled in the writing of Latin prose and verse. Thus the *Insula Sanctorum* became at the same time an *Insula Doctorum*—Island of Scholars.

Missionary Efforts.—Before the 7th century ended the monks had begun to carry Irish sanctity and Irish scholarship abroad. St. Columba (Columcille) of Derry settled in Iona in 563, and from that conveniently situated missionary center sent heralds of the Christian faith to the greater part of what is now Scotland. The Irish mold given to the Scottish Church was retained to the 12th century. In 635 missionaries were sent from Iona to Northumbria, where their work was remarkably successful. Irish missionaries labored, too, in East Anglia, Mercia, and even in Wessex, so that their share in the conversion of England to Christianity is very considerable. Owing to disputes about the paschal date, the close connection between Iona and Northumbria was broken in 664, but Irish influence continued, especially in the monasteries, where the alliance between asceticism and learning was maintained. Beyond the English Channel, in Continental Europe, St. Columban of Luxeuil was a zealous reformer as well as an enthusiastic monk. To the impulse given by his three original foundations in Burgundy, about 50 monasteries in the Frankish kingdom traced their origin. He was famous

also as a preacher of penance. His last foundation was at Bobbio, in northern Italy, a monastery that was to rank as a leading center of culture in Europe in the early Middle Ages. Irish saints and missionaries were to be found also in the eastern Frankish empire. St. Kilian (Cillian) was martyred at Würzburg; and St. Vergil of Salzburg (died 784), active as an abbot, bishop, and evangelist, was yet more renowned as a scholar. We know that he taught the sphericity of the earth and the existence of antipodes. In the 9th century, when the great tide of religious fervor was on the ebb, Ireland was still sending forth teachers to the Continent. Two of these, Sedulius the Irishman (Scottus) and John the Irishman (Johannes Scottus or Scotus, or Eriugena) have left names of distinction, the former as a poet and grammarian, the latter as a Neo-Platonist philosopher and theologian.

Church Decline and Revival.—About the middle of the 8th century monastic Ireland entered on a period of decline. The movement was accentuated by the confusion due to chronic raids (795–837), followed by more sustained attacks and partial settlement on the coast (Dublin, Waterford; and Limerick, in the Shannon estuary) on the part of the Northmen. These singled out monasteries and churches for destruction, in the first place because they were pagans, hostile to Christianity, in the second place because they were freebooters, who found the monasteries rich in artistic and other treasure. As the monasteries were also unprotected, they were easy and rewarding to despoil. The simple fact is that the chief occupations of the Norse during two centuries were robbery, arson, and murder. It is obvious that the losses, religious, cultural, moral, caused directly by them were immense; what cannot definitely be assessed is the indirect damage, due to the impossibility of normal progress, in the three spheres just mentioned, which their presence in the country occasioned. Unfavorable conditions in Rome and in the church generally at this time must also be taken into account. In Ireland, as elsewhere, the encroachment of the secular princes steadily increased. Armagh itself, the primal see, fell into the hands of a local sept, and was ruled by members of it who did not trouble to receive ecclesiastical orders from 957 to 1105. The enslavement of the church was complete.

Hardly had Hildebrand, the energetic Pope St. Gregory VII, died, when the reaction which he sponsored spread to Ireland. By the end of the 11th century it had gathered strength. Another 50 years, and reform on the widest scale was an accomplished fact. Important dates are 1101, when Cashel, the old capital of Munster, was bestowed as a gift upon the church and soon afterwards constituted a metropolitan see; 1106, when the Abbot of Armagh was consecrated bishop and the usurpation by laymen ended; 1111, when a synod held at Rathbresail, under the presidency of a papal legate, divided the country into territorial dioceses ruled by bishops; and 1152, when a synod at Kells, presided over by a cardinal sent for the purpose from Rome, completed the work of reorganization, so that it has never since required substantial alteration. Meanwhile, in 1148, the most distinguished of the reforming prelates, St. Malachy of Armagh, had died at Clairvaux. The old Irish monasteries, with their lands, had become the hereditary possession of lay lords to an extent that made their return to

their original status impracticable. They were therefore abandoned and a new monastic system, that of the Cistercians, similar to theirs in spirit, was introduced in their stead.

Assimilation of the Normans.—The Anglo-Normans invaded Ireland in 1169, and after 80 years of constant fighting they were masters of about two thirds of the country. Early in the 14th century the tide had turned and the Irish princes were winning back more and more of their ancestral lands. In the course of time the Norman lords became largely assimilated, so that it could be said of them that they were *Hibernicis ipsis Hiberniores*—more Irish than the Irish themselves. As there was no difference in faith between the Irish and the Normans, the problems which the church had to face were purely political. In general, the clergy of the two races may be said to have gone their separate ways. The great medieval religious orders flourished—Cistercians, Premonstratensians, Canons Regular, Knights Hospitaller of St. John of Jerusalem, Trinitarians, Franciscans, Dominicans, Carmelites, Hermits of St. Augustine, and Canonesses of St. Augustine. Where the writ of the English king ran he tried to control appointments to bishoprics. Attempts to exclude the members of one race from entering a community predominantly of the other race were condemned as unchristian by the popes. It is remarkable that throughout the whole medieval period no university was founded in Ireland: those who wished to secure an intellectual information of superior quality had to go abroad to find it.

Reformation Era.—When Henry VII mounted the throne of England in 1485 the power of the crown in Ireland was almost nominal. In the course of the half century that followed it became very real. Thus when Henry VIII declared himself supreme head of the church in his realms in 1534, the repercussions in Ireland were immediate. An archbishop who would carry out every royal wish was appointed to the see of Dublin by the king. All religious houses were suppressed. There was not, for the time being, any serious opposition: the local lords were ready to share in the monastic plunder; the prelates were induced to strain their consciences rather than die in what they took to be a passing quarrel; the mass of the people were bewildered and but dimly aware of the issue. The scene was transformed, however, under Edward VI, when the First Book of Common Prayer was introduced. No ability or violence on the part of the king's deputy and servants could get this Protestant liturgy accepted. Hence Queen Mary Tudor found no Protestants in Ireland to persecute. Her successor, Queen Elizabeth, again renounced the jurisdiction of the pope in matters spiritual, re-introduced the Book of Common Prayer, abolished the Mass, enjoined attendance at Protestant worship on Sundays and holy days under penalty of fine. For a decade or so after her accession the law last mentioned was but sporadically enforced.

With the excommunication of Elizabeth by Pope Pius V in 1570 quasi toleration ceased. The religious situation in Ireland was now abundantly clear: on the one side was the bulk of the Irish nation—Gaelic, Norman, settlers of English race and tongue in the medieval towns—immovable in loyalty to the inherited Catholic faith; on the other side was the governmental group, in number a small minority but possessed of the whole machinery of state and determined to use it to

make Protestantism the sole religion of the country. In the revolts of the next 30 years, that of Lord Baltinglas in Wicklow, that of the Desmond's in Munster, that of O'Neill and O'Donnell which spread to all Ireland, religion was never the sole but it was always a primary issue.

A peaceful solution was not found. The might of arms, confirmed by the victory at Kinsale (1601), enabled the English deputy and officials to take over the churches, cathedrals, ecclesiastical property of all kinds, and bestow them on their own nominees, who thus became in Ireland the counterpart and the projection of the Protestant Established Church in England. A university, exclusively Protestant in its constitution, was founded in Dublin by Queen Elizabeth in 1591. Into this church, however, and its university, the people refused to come. Appointments to the various sees were made by the popes, as formerly; and Catholic clergy, whatever the obstacles, continued to minister to their flocks. When persecution became active they went underground; when persecution relaxed they built modest chapels in laneways and remote places. To solve the problem of education, colleges for Irish students were opened abroad, at Salamanca, Louvain, Antwerp, Bordeaux, Compostella, Lisbon, and Rome.

Confederation of Kilkenny.—With the accession of Charles I came a small measure of relief. The king, refused supplies by his Parliament, was prepared to sell some concessions or "Graces" to the Irish Catholics for money. But persecution was soon renewed and was continued under Strafford. Growing discontent led to open revolt among the Catholics of Ireland in 1641. By the summer of 1642 the insurgents, who had set up legislative and executive machinery (the Confederation of Kilkenny) held the whole country with the exception of a few of the larger towns. Soon afterwards Charles I and his Parliament were at war. The Confederation was quite ready to lend aid to the king on the two conditions of complete religious toleration and a free and independent Irish Parliament. Pope Innocent X sent a nuncio, Rinuccini, archbishop of Fermo, to be his representative with the Confederation. Negotiations with the king and with his deputy in Ireland brought disunity into the Confederate councils, and the insurrection was already a failure when Charles I was beheaded and Rinuccini left Ireland for Italy. A month later (March 1649), Oliver Cromwell arrived in Dublin with a powerful Parliamentary army to begin a campaign that was to result in the annihilation of Irish resistance.

Protestant Ascendancy.—For the defeated Catholics there was no mercy. The "Cromwellian settlement" deprived them of all their lands in three out of the four provinces. Any men of mark whose lives were spared were ordered to transport themselves to Connacht, the poor province between the Shannon and the Atlantic seaboard. Soldiers and adventurers from England were settled on the confiscated lands. All Catholics were expelled from the towns and their places taken by Protestant burghers. In the sequel, the planters remained a relatively small minority but they possessed nearly all the good land, and with it the wealth of the nation, while the Catholics, despite predominance in numbers, were treated as an inferior class, tolerated only because they could serve the new owners.

Even after the Restoration of Charles II

(1660), the position of the Catholics in Ireland improved but little. Very few of those who had suffered for Charles I recovered their property. The Catholic population generally was miserably poor; priests were fined, imprisoned, and persecuted. Towards the end of the reign the "Popish Plot," invented by Titus Oates, brought about the imprisonment of many Catholic bishops and the hanging at Tyburn, London, on the evidence of perjured informers, of the primate and archbishop of Armagh, Oliver Plunkett (1681).

James II sought to place Catholics and Protestants on an equal footing, as well in Ireland as in Britain. When James lost the throne of Britain he found support in Ireland, where he landed in March 1689. A parliament, summoned by him to meet in Dublin, enacted that there should be complete religious toleration. The campaign which followed ended in his defeat and in the Treaty of Limerick (October 1691), one article of which guaranteed to the Catholics of Ireland such privileges "as they did enjoy in the reign of King Charles II." But this article was destined to remain a dead letter.

Penal Laws.—The 18th century, for the Catholics of Ireland, was the period of the Penal Laws. Catholics were excluded from the professions and from the more lucrative forms of trade; they could not become magistrates nor grand jurors, nor members of a town corporation. All ecclesiastical dignitaries were ordered to leave the country. Catholics were not allowed to have schools; and if educated abroad and ordained priests, were not permitted to return. After the death of George I (1727) these laws were less rigidly enforced. During the reign of George II it became clear that the Catholic Church could not be eliminated, and a mild movement for the repeal of the Penal Laws could be initiated (The Catholic Committee, 1757). Relaxations began in 1771, and Catholic relief bills were passed in 1778, 1782, 1792, and 1793.

Emancipation.—Before the Act of Union (of the kingdoms of Great Britain and Ireland) was passed in 1800, William Pitt, the English prime minister, let it be understood that the Catholics would be freed from their disabilities before the law, virtually at once. But King George III was so violently opposed to the suggestion that nothing could be done. The question was revived in 1805. Soon afterwards the Catholics of Ireland received a new and eminently capable leader in the person of Daniel O'Connell. Against the proposal that in reward for the granting of emancipation the British government should have a veto on the appointment of Irish Catholic bishops he set his face resolutely. When Catholic Emancipation was finally granted by the Duke of Wellington's government in 1829, its value was not diminished by any such condition. After 1829 Catholics in Ireland were free in legal theory; but their social status was still low, their proportion of the national wealth negligible, their educational facilities meager, their general condition backward and condemned to remain so for decades to come.

Protestantism Divided.—While the clergy and laity of native Irish race, the Anglo-Normans, and the old English merchants of the towns refused to accept the supremacy in matters spiritual of the English sovereigns, and the doctrines of the Reformers, the contrary was true of the officials and other new settlers of English race, and of some of the highly Anglicized families in

Dublin and its neighborhood. Protestantism in Ireland at the death of Queen Elizabeth was represented by this small group. Hugh O'Neill, earl of Tyrone, and Rory O'Donnell, earl of Tyrconnell (Tyrconnell), harassed beyond endurance by the Dublin government, fled to the Continent in 1607. They were immediately proclaimed outlaws, and their patrimony, with that of all their followers, was declared forfeit to the crown. Thus immense tracts of land, including almost all of the counties of Donegal, Derry, Tyrone, Fermanagh, Cavan, and Armagh, were at the disposal of King James; Antrim and Down were afterwards added. James I proceeded to plant all these lands with English and Scottish settlers. This policy was carried into effect. Among the colonists the Scots were more numerous than the English. Though the teaching in Trinity College, Dublin, from its foundation, had been Calvinistic in tone, and the Established (state-supported) Church in Ireland was far more Calvinistic in spirit than its counterpart in England, the English and Scottish colonists failed to agree, so that Protestantism in Ireland faced the future in two divisions—Protestants with episcopacy and Protestants without episcopacy (Presbyterians).

The Irish insurrection of 1641 brought heavy losses to the Protestant Episcopal Church. Cromwell's settlement favored the Puritans, who were the predominant element in the new class of landowners. Charles II did something to restore the balance; the Protestant Episcopal Church was again established and richly endowed, but "Acts of Uniformity" failed to compel the Presbyterians to accept its system. They went their own way as Nonconformists (dissenters).

Once James II had been defeated, the Protestant Episcopal Church was restored by William and Mary to its position of pre-eminence. All the lords and commoners who increased the severity of the Penal Code belonged to it. Hence not only the Catholics, who formed four fifths of the population, were penalized, but also Presbyterians, who refused to receive the Sacrament according to the usage of the Established Church, were disqualified from holding positions of honor and trust under the crown. George Berkeley and Jonathan Swift are the two prelates of greatest distinction during the 18th century. At the union of the kingdoms in 1800 the Established Church of Ireland was united with that of England.

Disestablishment.—After emancipation, the Protestant Episcopal Church continued to levy tithes on an extensive scale for its own upkeep from Protestants and Catholics alike. The impost was naturally resented by the Catholics and led to conflicts called the "tithe war." A solution that proved to be satisfactory was found in 1838. Meanwhile the anomalous position of the Established Church in Ireland had been brought to the notice of the Parliament in Westminster. No steps were then taken; but the census of 1861, which showed that the number of Catholics in Ireland was 4,505,265, while Protestant Episcopalians numbered 693,357, Presbyterians 523,291, Methodists and other dissenters 76,661, opened the way to an unanswerable claim for disestablishment (severance of the relationship to the state). This was carried through by Gladstone in 1869. By the Irish Church Act of that year the Protestant Episcopal Church of Ireland was disestablished and disendowed, but given at the same time complete freedom to provide for its

own future and liberally compensated for the pecuniary losses which the change involved. Legislative and administrative power resides since 1870 in a general synod consisting of the two archbishops and 12 bishops, and a house of representatives elected from the clergy and the laity. In the six counties of Northern Ireland still attached to Britain, the Protestant Episcopal Church continues to exert great influence. In the 26 counties, which in 1921 became Saorstát Éireann (the Irish Free State), and in 1949 the Republic of Ireland, it retains its university (Trinity College) and its two cathedrals in Dublin; it is also facilitated by the Ministry of Education, and is protected by express "recognition" in the constitution.

The affairs of the Presbyterian Church are regulated by a general assembly, presided over by a moderator who is elected annually. It has (1951) 580 ministers, 567 congregations, and 510 manse. Like the Protestant Episcopal Church, the Methodists, the Society of Friends, and the Jews, it is recognized as a religious body that merits protection in the constitution of the Republic of Ireland.

Constitutional Status of Catholic Church.—In that constitution the Roman Catholic Church receives special recognition "as a guardian of the Faith professed by the great majority of the citizens." It is governed, under the pope, by four archbishops (one of whom, the archbishop of Armagh, primate of all Ireland, is generally a cardinal) and 23 bishops. A central theological university (St. Patrick's College, Maynooth) and the three colleges of the National University of Ireland (founded 1910) at Dublin, Cork, and Galway, supply its needs in the sphere of higher education. Its missionary activity in lands of English tongue and, more recently, in Africa and the East, is very extensive.

In the Republic of Ireland, statistics give (1951) 2,786,033 Catholics (94.3 per cent); 124,829 Protestant Episcopalians; 23,870 Presbyterians, 8,355 Methodists, and 3,907 Jews. In the six counties of Northern Ireland there are 428,290 Catholics (.33:5 per cent), 390,931 Presbyterians, 345,474 Protestant Episcopalians, and 55,135 Methodists.

See also IRISH SCHOOLS AND SCHOOLMEN OF THE MIDDLE AGES.

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JOHN RYAN, S.J.

IRISH DRAMA. See IRISH LITERARY REVIVAL; IRISH LITERATURE IN THE ENGLISH LANGUAGE.

IRISH ELK. See FALLOW DEER.

IRISH FREE STATE. See IRELAND, REPUBLIC OF—History.

IRISH LANGUAGE. See CELTIC LANGUAGES; GAELIC LITERATURE.

IRISH LITERARY REVIVAL is the name customarily used to denote the literary activity in Ireland during the first half of the 20th century. Sometimes it is spoken of as the Celtic renaissance, a wider and looser term.

Background and Beginnings.—The Irish literary revival took place during the life span of William Butler Yeats (1865–1939), the Irish poet, and it would not be completely untrue to say that his work constituted most of what is spoken of as the Irish literary revival. The reasons for a renaissance taking place at one particular time more than at any other are rarely valid, because this presupposes that every renaissance must have a precise and scientific explanation. What really seemed to have happened at the time of the Irish literary rebirth was that Ireland, during a period of utter despair, suddenly found herself with an important poet in the family. The betrayal of Charles Stewart Parnell (q.v.), the uncrowned king of Ireland, crushed Ireland politically, and for the moment it seemed as if there was nothing Irishmen could do except look into their own hearts. For about 10 years after the death of Parnell in 1891 there was a lull in Irish politics, and it so happened that Yeats, a major poet, was beginning his career at this time and was able to take advantage of the silence to lay the foundation for his work later on. Without Yeats there would have been no literary revival. It is just that simple; but there were situations and influences, both political and emotional, which helped him in his work, and those are things that may be explained logically. To understand their significance, however, it is necessary to know something of the background of Irish literary and political history.

Since about 1170, the year the Anglo-Normans invaded Ireland, the population of the country has been divided into two classes: those who speak English and those who speak Gaelic. The English speakers became the ruling class and are referred to as the Anglo-Irish. England was generally regarded by the Anglo-Irish as the mother country and, to them, English literature was the only literature. It was to this class that George Farquhar, Oliver Goldsmith, Richard Brinsley Sheridan, Jonathan Swift, Oscar Wilde, and others belonged. The Gaelic speakers, though a majority, were regarded by the Anglo-Irish as mere natives, and although they produced a considerable literature in the Gaelic language, it remained virtually unknown to the Anglo-Irish until the middle of the 19th century. The Anglo-Irish writers were content to write in the English tradition because they were not aware of any other one in which they could write. The result was that though they did very fine work, there is little about it that can be considered distinctively Irish. Whether or not this was a defect is a question that does not concern us here; but there is no denial that their work was good, despite what some consider its un-Irish flavor.

Discovery of the Gaelic Tradition.—During the early years of the 19th century, hints that there was a Gaelic tradition began to filter into Anglo-Irish writing, and Thomas Moore's *Irish Melodies* (1804–1834), though written for an English public, were perhaps the first revelation of a distinctly Irish spirit in Anglo-Irish writing. Jeremiah Callanan (1795–1829) also caught something of the Irish spirit, and his verse shows the influence of the cadences of Gaelic versifica-

tion. Neither Moore nor Callanan, however, was completely aware of the Gaelic tradition.

Towards the middle of the century a few curious professors discovered Gaelic literature and undertook to translate many of the Gaelic sagas as a kind of scholarly exercise. In 1840, for instance, the Irish Archaeological Society was founded for the purpose of preserving Gaelic manuscripts and for their translation into English. The interest shown in Gaelic Ireland by this society was purely academic; its patrons were mostly members of the British aristocracy, and had they been able to foresee that their society was laying the foundations of what has since been regarded as a nationalistic literature, it is doubtful that they would have continued with their work. Other societies were formed later: the Celtic Society in 1845 and the Ossianic Society in 1853. These societies did good work and gave employment to at least three important scholars, John O'Donovan (1809-1861), Eugene O'Curry (1796-1862), and Standish Hayes O'Grady (1832-1915). These scholars translated most of the ancient Irish sagas and poems and published the result of their work in the journals of the societies. Many German scholars joined in the philological aspect of the work, the most notable being Johann Kaspar Zeuss, Rudolf Thurneysen, and Kuno Meyer. In 1853 Zeuss published a Gaelic grammar, *Grammatica Celtica*.

Men of creative genius such as James Clarence Mangan (1803-1849), Sir Samuel Ferguson (1810-1886), and Standish O'Grady (1846-1928) were excited by the discoveries of the scholars, they having been educated to believe that there was no literature outside of English literature. Immediately they began to rewrite the stories and poems of Gaelic Ireland in romantic fashion. Mangan and Ferguson were interested mostly in the poems, and some of their interpretive translations are among the finest poems in Anglo-Irish literature. Thomas Osborne Davis, Charles Gavan Duffy, John Mitchel, and a few other nationalistic politicians and journalists saw in the discoveries something they could use to further their political cause, and they wrote about it in their newspapers and preached it from their platforms.

But it was Standish O'Grady's translations of the sagas and his *History of Ireland* (1878) that had the greatest influence. O'Grady, believing in the sacredness of ancient tradition, saw that it would be disastrous to allow Ireland's past to be hidden away in scholarly publications. He decided to rewrite the stories in popular fashion. This he did brilliantly, not only in his *History of Ireland*, but also in *Cuculain and His Contemporaries* (1880) and other books.

Influence of Yeats.—All this happened at a peculiarly fortunate moment. Victorian literature was running its course, was becoming cliché and barren, and the Anglo-Irish writers were delightfully shocked when they found a new well of inspiration in Gaelic tradition. It was at this precise moment that Yeats was born. Yeats belonged to the Anglo-Irish class, and consequently did not understand a word of the Gaelic language. But his imagination was fired by O'Grady's translations, and on many occasions he acknowledged his indebtedness to him. George Russell (AE), in an introduction to the works of O'Grady (Dublin 1919), spoke not only for himself but for all the writers of the Irish literary revival when he wrote:

When I close my eyes and brood in memory over the books which most profoundly affected me I find none excited my imagination more than Standish O'Grady's epical narrative of *Cuculain* . . . With reference to Ireland, I was, at the time I read, like many others who were bereaved of the history of their race. I was a man who, through some accident, had lost his memory of his past, who could recall no more than a few months of a new life, and could not say to what songs his cradle had been rocked and what mother had nursed him, who were the playmates of childhood, or by what woods and streams he had wandered. When I read O'Grady I was as such a man who suddenly feels ancient memories rushing at him, and who knows he was born in a royal house, that he had mixed with the mighty of heaven and had the very noblest for his companions. It was the memory of race which rose up within me as I read, and I felt excited as one who learns he is among the children of kings. That is what O'Grady did for me and for many who were my contemporaries. . . . In O'Grady's writings the submerged river of national culture rose up again a shining torrent, and I realised as I bathed in that stream that the greatest evil one nation could inflict on another was to cut off from it the story of the national soul.

Having made this great discovery, Anglo-Irish writers were fired with interest in Irish literature and in the spirit that pervaded it. Many looked for guidance as to how they might make the best use of their discovery, and Yeats was fortunately there to direct the form it should take. Yeats perceived that Gaelic-speaking Ireland rarely read anything, but was always willing to listen, whether it be to a political speech or to a sermon. From his awareness of this fact rose the idea of founding a theater which would be truly representative of the real Ireland so ignored by his class. He would establish a poetic theater.

Having decided that a theater was what was needed, Yeats set about preparing the country for it. He felt that the Irish mind was too long enslaved and that a literary revival would not be possible until national pride was reawakened in the Irish people. He at once became a vigorous nationalist and developed a deep personal regard for John O'Leary, the Fenian leader. He also met Maud Gonne, a violent nationalist, fell in love with her, and for her wrote *The Countess Cathleen* (1892).

Literary Societies.—It seemed to Yeats that Ireland was not quite ready to receive him, so he moved to London, where he drifted for a time into the circle of the Aesthetes. O'Leary and his other friends, fearing that he was in danger of selling his soul for an empty aestheticism, begged him to return. He did not do so immediately, and in 1891, with two other Anglo-Irish writers, Thomas William Rolleston and John Todhunter, founded the Irish Literary Society in London. This society attracted to it most of the other Anglo-Irish writers who were living in London, including Katharine Tynan, Alice Milligan, William Larminie, and Stopford Brooke. All of these writers were extremely minor, but they were almost carried into significance by the influence of Yeats and the romanticism created by O'Grady and the rest. In the same year Yeats went over to Dublin and established there a similar society, The National Literary Society. John O'Leary was its first president, and its members included Douglas Hyde, George Sigerson, and Standish O'Grady.

Gaelic League.—The purpose of these societies was to give an opportunity to a new generation of critics and writers to denounce the propagandist verse and prose that had gone by the name of Irish literature and to substitute for it certain neglected Irish writers such as Sir Samuel Ferguson, Standish O'Grady, and James Clarence

Mangan. The society had no political affiliations. From this society sprang the Gaelic League, founded in 1894 by Douglas Hyde (q.v.). Hyde's idea was to revive the Gaelic language, which was then dying, as the spoken language of the whole country. Yeats did not think it worth his own while to learn the Gaelic language, but he supported the Gaelic League (before it became a propaganda machine) because he considered it an effective means of awakening the Irish people to a consciousness of their history and tradition. Douglas Hyde, though mostly a pamphleteer in favor of the Gaelic language, did some writing that had a significance for the Irish literary revival. His *Love Songs of Connacht* (1894), translations from the Gaelic, helped to set the mood for writers of the revival movement. His *Literary History of Ireland* (1899) was also a valuable contribution.

Irish Literary Theatre.—The literary societies of London and Dublin created an audience for Yeats and his ideas. In 1889 Yeats published *The Wanderings of Oisín*, and during the 1890's he was writing the lyrics which formed the volume, *The Wind Among the Reeds*. In 1893 he published a collection of fairy lore which he entitled *The Celtic Twilight*. The following year he had his poetic play, *The Land of Heart's Desire*, produced in London.

But despite his success in London, Yeats could see that only in Ireland could he do the things he wished to accomplish; so, with the help of George Moore, the novelist, and Edward Martyn, a wealthy Irish landlord and minor playwright, he went to Dublin and produced his own play, *The Countess Cathleen*, and Martyn's *The Heather Field* at the Antient Concert Rooms in 1899. To Yeats' amazement his play was received with boos and hoots because some saw in it a theological heresy. When he recovered from the surprise, Yeats accepted the insults as the traditional greetings for a messiah, and, from then on, always treated the mob, whether it be English, Irish, or American, with violent disdain.

He named his dramatic company The Irish Literary Theatre, and was back in Dublin the following year with another series of plays. After producing the third series of plays in Dublin, in 1901, he rid himself of George Moore and Edward Martyn and associated himself closely with Lady Augusta Gregory, a friend of his from Coole, in the west of Ireland. Yeats had not given up the idea of founding a poetic theater in Ireland, and in 1902 he had another play which he had written, *Cathleen Ni Houlihan*, produced by a group of actors led by the Fay brothers, Willie and Frank. He formed another society, the Irish Dramatic Company, consisting of himself, Lady Gregory, the Fay brothers, and John Millington Synge, an Irish writer whom he had discovered in a Paris garret. It was Yeats' ability to discover genius that made an Irish literary revival possible.

Synge and Lady Gregory.—When Synge returned from Paris, on Yeats' urging, he first went to live among the gypsies in Wicklow and, later, among the inhabitants of the Aran Islands, off the west coast of Ireland. The peasants on the Aran Islands spoke the Gaelic language but also knew a little English. Synge quickly absorbed the life of these primitive people and wrote plays about them. *Riders to the Sea* is a one-act tragedy about an island woman who has lost all her sons to the sea; while Irish, it

has many of the elements of Greek tragedy. *In the Shadow of the Glen* was disliked because Synge tells of an unfaithful Irish wife. *The Playboy of the Western World* raised an even bigger storm. In this play Synge tells how the peasants in a village in the remote west of Ireland hide a young fellow (the Playboy), who claimed that he was fleeing from the police because he had killed his Da (father) with a blow of a loy (long, narrow spade). This was too much for an Irish patriotic audience, and they rioted at the first performance because they considered the play an insult to Irish character by suggesting that these peasants would condone a murder. This, they claimed, was not the kind of play that should be put on by a theater that claimed to be national. Yeats' policy, however, was not to give the public what they liked but rather what he thought was good for them, so he called in the police and continued the play under heavy guard. This was the final insult from the point of view of Irish patriots, and they avoided Yeats and his plays in the future. Yeats, however, had a decided plan of action and he carried on, despite all opposition, to give Ireland a literature worthy of her tradition. Synge died in 1909, his death being a great loss to the Irish literary revival.

Lady Gregory (1859-1932), too, began to write plays under Yeats' influence and direction. She is best known for her comedies, *Spreading the News*, *Hyacinth Halvey*, *The Rising of the Moon*, and many others. She also translated many plays from the French and was interested in the folklore of Ireland. Hence her books *Cuchulain of Muirtheimne* (1902), *Poets and Dreamers* (1903), *Gods and Fighting Men* (1904), *A Book of Saints and Wonders* (1906). Lady Gregory wrote her plays in dialect, and the language of the Irish literary revival is sometimes referred to as the Kiltartan dialect, a name taken from the parish where Lady Gregory lived.

Abbey Theatre.—In 1904 Miss Annie Elizabeth Fredricka Horniman, a wealthy English lady, presented Yeats with a small theater in Abbey Street, Dublin, named the Abbey Theatre. From 1904 onwards the Abbey Theatre was the center around which the literary revival in Ireland moved. Now that he had a theater of his own, Yeats put into effect his theories and ideals. First of all it would be a poetic theater where the imaginative mind of Ireland would find expression. It was to be a place almost as sacred as a church, and those who come there must not expect vulgar entertainment but must come rather to listen to a poet explain his vision. Above all, there was to be no place in it for politics, because politics presuppose defense and argument, and a continual apology makes the mind barren and kills intellectual innocence. He wanted the plays performed there to be literature and to have style. Furthermore, the English language, according to Yeats, had worn itself out during Victorian times, and his theater needed a language that was fresh. The Gaelic language would be acceptable, but none of the literary revivalists knew that language. The language Yeats finally adopted was the dialect of English spoken by the peasants from the west of Ireland. Although these peasants spoke English, they thought first in Gaelic, and the result was a fresh and unspoiled language with personality. This is the language used in the plays of Synge and Lady Gregory. As found in the plays, it is

not completely authentic, but it has a quaint, unreal, dreamy flavor; hence the slightly derogatory term sometimes applied to this movement—the Celtic mist.

Yeats also had fixed principles on acting, which was to be statuesque and unobtrusive—as fitting for a drama which was to be poetic and ritualistic. Yeats disliked a large audience in his theater, and the plays frequently infuriated those who came, especially when it was thought that the ideas expressed ran counter to popular national sentiment. Sometimes it appeared to the politicians that Yeats was an enemy of Ireland, but he refused to be dictated to and followed his own ideals to the end. The result of this policy was that he established a literature of the highest integrity and which expressed the Irish spirit and tradition.

Sean O'Casey.—Yeats discovered not only Synge but also another major dramatist—Sean O'Casey. O'Casey was born in the poverty-stricken slums of Dublin. He received little formal education, but he read widely and attended the Abbey Theatre whenever he could afford the entrance price of sixpence. He submitted a play to the Abbey, but it was rejected with some encouraging remarks. The next play he sent in, *The Shadow of a Gunman* (1923), was accepted and was an immediate success. Like all his early plays, this one was centered around the Dublin slum-dwellers. It is realistic, but is lifted to an imaginative level; it is also extremely amusing. Then followed his greatest play, *Juno and the Paycock* (1924), also about life in the slums of Dublin. The characterization is brilliant. Lady Gregory said that the play reminded her of Tolstoy, and other critics have described it as the greatest play since *Hamlet*. O'Casey's next play, *The Plough and the Stars* (1926), caused a riot in the theater because some oversensitive patriots thought it an attack on Irishmen who fought during the Easter Rising of 1916. The dialogue in these early plays by O'Casey is the most authentic Irish dialect of all the plays of the Irish literary revival. Shortly after the production of *The Plough and the Stars* O'Casey went to live in London, and though he subsequently wrote many plays they can hardly be said to belong in spirit to the Irish revival.

Other Dramatists.—Yeats was also responsible for the discovery of many other dramatists, of whom Lennox Robinson and T. C. Murray are the most important. Murray is best known for his plays *Birthright* (1910) and *Maurice Harte* (1912), which treated of Irish peasant life in a lyrical fashion. Robinson wrote many plays, but is best known for *The Far-off Hills* (1928), *Drama at Innis* (1933), and *Church Street* (1934). Robinson wrote realistically of the broken-down Anglo-Irish aristocracy. Other plays worth mentioning as belonging to this period would be St. John Ervine's *Mixed Marriage* (1910), and Paul Vincent Carroll's *Shadow and Substance* (1937). This play by Carroll was the last play of any consequence performed at the Abbey Theatre before the death of Yeats and the ultimate collapse of the Abbey as a theater of integrity.

Yeats the Poet.—Yeats was not a great dramatist and, though he wrote plays that were memorable, he will be remembered primarily as a poet. His early verse is strongly influenced in subject by pre-Christian Ireland and in form by the aesthetic and symbolistic movements in Eng-

land and France. This is especially true of his early collection of poems, *Poems* (1895), and *Wind Among the Reeds* (1899). In his later verse he outgrew his "Celtic twilight" mood as in *The Wild Swans at Coole* (1917); there we find him stretching for a more eternal subject. *The Tower* (1927) and *The Winding Stair* (1929) contain much of his best and most vigorous poetry. Yeats also wrote *The Celtic Twilight* (1893), a collection of folk stories.

George Bernard Shaw.—While Yeats was carrying on a literary revival in Ireland, Bernard Shaw (1856-1950) was engaged on one of his own in England. Although he did not write in the "Celtic twilight" tradition, he undoubtedly must be regarded as a major figure in the Irish literary revival. He was an intellectual as opposed to an imaginative writer, and his clear views and pungent satire acted as an antidote to those writers who frequently drifted out of the Celtic mist into a Celtic fog. He was born in Dublin, and all through his life that city remained his emotional home. He was employed as a clerk in a realtor's office for a short while, but retired from it and went to London to make his way as a writer. His early years in London were difficult, and although he wrote five novels he could not find a publisher for them. He was a successful music critic for a while. Then he became interested in play writing and discovered there one of his greatest talents. For over 50 years thereafter he wrote plays of all types—histories, comedies, sketches, farces. He ignored conventional plots, and many of his plays might be described as brilliant conversational pieces. Some of his best known plays are: *Candida* (1895), *John Bull's Other Island* (1904), *The Doctor's Dilemma* (1906), *Pygmalion* (1912), *Saint Joan* (1923), the last considered by many to be his best play. A large number of his plays were produced at the Abbey Theatre in Dublin despite the fact that Yeats disliked plays that were not founded on a poetic idea. Shaw wrote brilliantly on every topic, and was an entire Irish literary revival in himself.

George W. Russell and Others.—Even in Ireland, Yeats was not the only influence though he was by far the greatest. George W(illiam) Russell (1867-1935), better known as AE (Æon), though not a great poet, gathered around him many writers of talent. He was a mystic, economist, painter, and essayist as well as a poet. He was born in County Armagh but moved to Dublin at an early age, and was a student of the Metropolitan School of Art before he was 13 years old. There he met Yeats, and through him became interested in theosophy. His *Homeward: Songs by the Way* (1894) attracted wide attention. In 1897 he joined the Irish Agricultural Organization Society, and in 1906 became editor of *The Irish Homestead*, journal of that society; in 1923 *The Irish Homestead* amalgamated with *The Irish Statesman*, with Russell remaining as editor. *The Irish Statesman* was unique as a magazine in that it was read by intellectuals in most countries, as well as by Irish farmers. AE attracted to his magazine all the best writers, and all of them felt honored when their writings appeared in it. AE's home in the Dublin suburbs was the meeting place of most of the writers associated with the Irish literary revival.

AE had a religion all his own, which some wit described as AEtheism; it was a mixture of

Irish mythology and Hindu philosophy. He sought in the Irish mythology for hints of an ancestral lore identical with that of the Eastern sages. This mystical religion influenced his contemporaries, and contributed to the "Celtic mist." AE expounded his religious philosophy in *The Candle of Vision* (1918), and his political idealism in *The Interpreters* (1920). His collected poems were published in 1913, but he wrote much that was of interest later on, especially *The House of the Titans and Other Poems* (1934). Perhaps because he was a lesser genius than Yeats, he was easier to approach and therefore had a greater influence, more personal if less profound than Yeats'.

Minor writers of the movement who gathered under AE's cloak were, Alice Milligan, Eva Gore Booth, Padraic Colum, Ella Young, and Seumas O'Sullivan. Although these minor writers may have failed as poets of consequence, they served as a necessary backdrop for the literary revival. Of the minor writers, Francis Ledwidge (1891-1917), showed most promise, but his career was cut short when he was killed in action in Flanders; his two books of poems, *Songs of the Field* (1915) and *Songs of Peace* (1916), had a magic quality and in form were heavily influenced by the Gaelic poetic mode.

Before *The Irish Statesman* became defunct in 1930, AE introduced in its pages poets who, if they did not belong to the Irish literary revival proper, at least developed from that stream and initiated a secondary revival in Irish poetry and letters. Frank O'Connor (born in 1901), though now known only as a story-teller, began as a poet in *The Irish Statesman*. Frederick Robert Higgins (1896-1941) was another; he came from Meath, Ledwidge's county, and his verse has much in common with that of Ledwidge. He wrote of the fields in a lyrical fashion, but his verse lacks intensity and that inner sincerity which is essential to poetry. *Dark Breed* appeared in 1927, *Arable Holdings* in 1933, and *The Gap of Brightness* in 1940. Higgins was managing director of the Abbey Theatre for a while before he died.

Patrick Kavanagh (born in 1904) also began as a poet in *The Irish Statesman*, but after the death of AE he disentangled himself from those influences associated with it and wrote freshly and originally about the Irish countryside; of his books of verse, *A Soul for Sale* (1947) is the most significant. He is also the author of *The Green Fool* (1938), a prose work which is a mixture of autobiography and fiction. *Tarry Flynn* (1949) is a novel on the frustration in Irish country life; the romanticism of the Celtic twilight is cast aside for a less charming but more sincere approach.

Prose Writers.—Although poetry and drama predominated during the Irish literary revival, the prose writing of the period is also significant. The novelists, like the playwrights, broke away from the 19th-century tradition, which usually displayed the Irishman as a wild, screaming lunatic who carried a clay pipe in his hat and a shillelagh in his hand.

George Moore (1852-1933) was the most important prose writer of the early years of the movement. He was born in Mayo, but lived for many years in Paris and in London. He was deeply influenced by Gustave Flaubert and Honoré de Balzac, and is a brilliant stylist. He wrote many realistic novels, the most notable

being *Esther Waters* (1894). He has been called the first realistic novelist since Daniel Defoe. In 1900 he assumed a nationalistic pose and returned to Ireland, but his nationalism was too flamboyantly insincere and only caused embarrassment to those supporting what they cryptically called "the cause" (meaning the cause for Irish political independence). Yeats described Moore as "preposterous and ungovernable." While in Ireland, Moore wrote a series of short stories of Irish life which were published under the title *The Untilled Field* (1903); they were translated into the Gaelic language also. Moore's greatest contribution to the Irish literary revival was his trilogy, *Ave* (1911), *Salve* (1912), and *Vale* (1914). These books give a fascinating and slightly comic account of the Irish literary revival and of all those associated with it; they are brilliantly satiric, and should be read by anyone interested in knowing more of the Irish literary activity. Moore was a mocker and a blasphemer, and he laughed to the very end. On his instructions, his body was cremated and the ashes deposited in a hole on the top of a mountain on his estate in the west of Ireland. AE preached a panygeric on that occasion in which he pointed out that Moore "loved the land if he did not love the nation."

James Stephens (1882-1950) began writing as a poet, but he suddenly achieved fame as a prose writer in 1912 with the publication of *The Crock of Gold*. This book is unique and difficult to label. It is a brilliant fantasy, resembles a novel in form, and has an Irish background; it has been universally recognized for a long time as a classic. Some of his other books of prose are *The Charwoman's Daughter* (1912) and *The Demi-Gods* (1914). It has been remarked that his prose is closer to poetry than much of his verse. John Millington Synge, the playwright, wrote two volumes of travel-sketches, *The Aran Islands* (1907) and *In Wicklow, West Kerry and Connemara* (1910) which are interesting for their style and for their description of Irish life. Edith Anna O'Enone Somerville and Martin Ross (Violet Florence Martin) collaborated in a book entitled *Experiences of an Irish R.M.* (1899) which is considered by some to be very amusing.

Seumas O'Kelly wrote a number of plays, including the very sentimental *The Shuiler's Child* (1909), but his best work is the short story, *The Weaver's Grave* (1920), which describes the peculiar fear of the Irish peasant that he might, in error, be buried in someone else's grave. Daniel Corkery (born in 1878) wrote some good realistic, though quiet, stories of Irish country life, including *The Threshold of Quiet* (1917) and *The Wager and Other Short Stories* (1950); he is also the author of *The Hidden Ireland* (1925), a study of Gaelic Ireland in the 18th century. Lord Dunsany (born in 1878) is worth mentioning for his fantasies: *The Gods of Pegana* (1905), *Time and the Gods* (1906), *The Sword of Welleran* (1908), *Dreamer's Tales* (1910), and many others. His fantasies, however, lack the high imaginative qualities of those by James Stephens. Flann O'Brien (1911-) is the author of a notable fantasy, *At Swim-two-birds* (1939).

Joyce.—James Joyce (1882-1941), though he disavowed any connection with the Irish literary revival, is nevertheless generally regarded as a distinct part of it.

But I must not accounted be
One of that mumming company

he wrote of Yeats and the Abbey Theatre. He was born in Dublin and attended the Jesuit college of Clongowes Wood. In 1907 he published a little book of lyrics entitled *Chamber Music*. Seven years later *Dubliners*, a book of short stories about Dublin life, was published. It showed that its author had a sharp perception for the nuances of Dublin dialect, which he used with skill. The cold style was learned from Gustave Flaubert, and it was particularly suited to his Thomistic temperament. *A Portrait of the Artist as a Young Man* which followed in 1916 is also about Dublin life, but is slightly scholastic in tone. Joyce, unable to make a living in Dublin, went abroad and lived in Trieste and Paris while he worked on a new book, *Ulysses* (1922). This was a novel of Dublin life, and though it is extremely long, the action takes place all in one day. Joyce employed in this novel a new technique which has been described as "the stream of consciousness." By this is meant that he records the conscious and sub-conscious thoughts of his characters and allows them to weave in and out of the story in what might appear to be a disorder. This new method of novel writing caused a sensation and it was much discussed in intellectual societies in Paris and America. The book is still banned in many countries for its alleged obscenity. The hero of *Ulysses* is Leopold Bloom, a Jew, and Joyce intended that he represent the human race. The dialogue is realistic and alive. *Finnegans Wake* (1939) is even more obscure than *Ulysses*. It is highly praised by those who profess to understand it, and by others it is condemned as the ravings of a sick mind. Joyce had no successful imitators, and AE said of him that he was a cistern and not a fountain.

Novelists.—Liam O'Flaherty, Peadar O'Donnell, and Frank O'Connor are all realists. Liam O'Flaherty was born on the west coast of Ireland. His early short stories describing the life lived in that area have both freshness and vigor; his realism is always touched with a lyricism which lifts his stories to an imaginative plane. He is the author of many novels and books of short stories, including *Thy Neighbour's Wife* (1924), a novel; *Spring Sowing* (1926), stories; *The Informer* (1926), a novel; *Famine* (1937); *Short Stories of Liam O'Flaherty* (1937); and *Two Lovely Beasts* (1948). He also wrote short stories in the Gaelic language. Peadar O'Donnell was born in Donegal, among the Gaelic-speaking peasants of that area. His novels, which portray the life of the poverty-stricken peasants struggling to survive, include *Islanders* (1925), *Adriagoole* (1928), *The Knife* (1930), and *On the Edge of the Stream* (1934). He had a passion for justice, and this caused him to devote much of his time to humanitarian work on behalf of the Donegal migrant laborers.

Frank O'Connor was born in Cork about the year 1901. He fought in the struggle for Irish political freedom in the early 1920's, and his first book of stories, *Guests of the Nation* (1931), told of his experience as a rebel. He came under the patronage of AE, who brought him to Dublin and arranged a job for him as librarian. Most of his early work, which is full of vitality, appeared first in *The Irish Statesman*. In 1932 he published his first novel, *The Saint and Mary Kate*. Those that followed included

The Wild Bird's Nest (1932), *Bones of Contention* (1936), and *Selected Short Stories* (1946). He wrote two plays while he was a director of the Abbey Theatre and translated many poems from the Gaelic, including Merri-man's *The Midnight Court*. The scene of most of his stories is laid in Cork. His early stories are his best work.

The autobiography in four volumes of Sean O'Casey, the playwright, is an important contribution to Irish prose writings: *I Knock at the Door* (1939), *Pictures in the Hallway* (1942), *Drums under the Windows* (1945), and *Inisfallen, Fare Thee Well* (1949). Of the four volumes the first, which is probably the best, describes O'Casey's childhood and the Dublin life of the time; the style is vigorous and the point of view clear. *Drums under the Windows* is unfortunately influenced to its detriment by the style of James Joyce. *Inisfallen, Fare Thee Well* discusses, among other things, his own relation to the Irish literary revival.

Essayists.—The essay form was widely cultivated during the period under review. Almost every Irish writer wrote essays. Yeats is probably the most important essayist, because he was the most important writer. Many of his early essays appeared in *Bealtaine* and *Samhain*, the periodicals issued by the Irish Literary Theatre. Many of his books of prose consist of essays—such as *The Cutting of an Agate* (1912), *The Trembling of the Veil* (1922), and *Dramatis Personae* (1936). Yeats was a brilliant essayist, and though he had a clear style, he concentrated more on saying something than on the means of saying it.

AE also wrote essays of a high order of merit, most of them appearing in *The Irish Statesman*. The essays of Shaw on every conceivable topic are so well known that it would serve no purpose to discuss them here. George Moore wrote many delightful essays on literature, art, and music. While they are noted more for their style than for their content, there are critical comments and ideas in them that have more than passing value. John Eglinton (William Kirkpatrick Magee) concentrated on the essay form alone; the fact that he was a close friend of Moore is sufficient to indicate that his attitude was sceptical, detached, and ironical. Eglinton set himself the task "to introduce new unassailable ideals of nationality, to sink the wells of thought beneath the barren surface of tradition, and to bring Ireland into political and spiritual unity." Although a definite part of the Irish literary revival, he had, like Moore, little sympathy with it. He is a fine stylist, and Yeats described his writings as full of "orchestral harmonies." However, he had little to say that was original, and he took his stand in favor of cosmopolitanism in literature rather than nationalism. He came from the north of Ireland, and perhaps this had some influence on his point of view. His books include: *Two Essays on the Remnant* (1896), *Pebbles from the Brook* (1901), and *Anglo-Irish Essays* (1917). Ernest Augustus Boyd was an essayist and critic. Two of his books are important: *Ireland's Literary Renaissance* (1916) and *The Contemporary Drama of Ireland* (1918).

Ballads.—Ballad writing was popular during the period, and many of the ballads, written anonymously, will remain permanently in Irish literature. Some of the ballad writers whose

names we know are: Alfred Perceval Graves, author of *Father O'Flynn*, Patrick Joseph McCall, who wrote *Irish Fireside Songs*, and Francis Arthur Fahy, author of *The Ould Plaid Shawl*.

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PETER KAVANAGH,
Author of "*The Irish Theatre*" and "*The Story of the Abbey Theatre*."

IRISH LITERATURE IN THE ENGLISH LANGUAGE. This phrase is used to indicate the writing of those persons who, though born in Ireland, wrote exclusively in the English language and, generally speaking, directed their writing toward an English public.

Until the mid-19th century the majority of the Irish people spoke only Gaelic, and only a very small, but important, minority spoke English. The first contingent of Anglo-Norman invaders entered Ireland in 1169; the towns were quickly seized by the Strangers (as they were called), and an English-speaking colony was established. Strengthened by succeeding expeditions in 1170 and 1171, the English-speakers became the ruling class and generally were disliked by the native Irish. After some generations the early English settlers became more Irish than the Irish—as one writer put it; and they, in turn, resented all subsequent invasions by the English. However, they always regarded England as the mother country, in much the same manner as the Irish-Americans regard Ireland. Until early in the 20th century the English-speakers never really amalgamated with the native Irish or Natives (as they called them); consequently reference is usually made to them as the Anglo-Irish.

Extreme Irish nationalists sometimes speak disparagingly of the Anglo-Irish and accuse them of being un-Irish. This is a narrow view based on the false notion that only those who speak flatteringly of a country can justly claim to be its citizens. In fact, it was precisely because the Anglo-Irish were not encumbered with a false sentiment for Ireland that they wrote so well and added so much luster to Irish literature. They wrote, it is true, for an English public, but, because they were Irish and living in Ireland, they necessarily must have had Irish emotions. Anglo-Irish writers could not escape, even if they had so wished, the Irish color and attitude. But even if no Irish attitude were obvious in their writing, there would be nothing requiring apology. What really mattered is that they wrote well.

The contribution to English literature by Irish writers using the English language is greater than one may assume from a casual glance. Immediately the names of the best Irish

writers come to mind—Jonathan Swift, Oliver Goldsmith, Richard Brinsley Sheridan, Oscar Wilde, Bernard Shaw—but there are many others whose writing has added vigor to what is called English literature. It is possible to exclude the Brontës (whose father was Irish) and William Congreve (who spent the most impressionable years of his life in Ireland) and yet to have a very impressive list. There is no branch of English literature which Irish writers have not invaded and at times have dominated. It is said sometimes that Irish literature in English began with Swift (1667–1745), but the inaccuracy of this statement is demonstrated by St. John Seymour in his book *Anglo-Irish Literature, 1200–1582*. There he quotes a poem entitled *The Land of Cokaygne* (written in the last half of the 13th century) in which the friars of Kildare are satirized because they appear to have made, in dumb show, theatrical representations of some of the incidents in the Bible. So quick were the Anglo-Irish to adopt the drama, and so great is their accomplishment in this branch of literature alone, that it may be best to discuss first their contributions to drama.

DRAMA

Beginnings of the Drama Form.—The earliest reference to a dramatic entertainment occurring in Ireland is in a document consisting of 17 constitutions of a Dublin provincial council which Archbishop Thomas Minot held at Kilkenny in 1366. According to the seventh constitution, which is entitled *Constitutio ne mercata in ecclesiis vel earum acris seu cimiteriis teneantur, nec negociaciones seculares exerceanntur*, priests are ordered to forbid "such theatrical games and frivolous spectacles, by which the churches are dishonored; and the aforesaid priest must warn them, under suspension, and order them in future to abstain from such acts and to cease from them under pain of greater excommunication."

It is clear from this canon that in Ireland at that early period plays of some kind were acted both in the churches and in the cemeteries. We know that it was customary in both England and France at the same period for plays to be acted inside churches, and that ecclesiastical authorities legislated against the practice. In Marsh's Library, Dublin, is a copy of a religious processional, written in the 14th century and owned in the 15th century by the Church of St. John the Evangelist, Dublin. It is the usual type of processional, describing the coming of the three Marys to the tomb of Christ, but written as a play. There is, however, no conclusive evidence that it was performed in Ireland. Again, *The Pride of Life* (1343), of which the manuscript was discovered in Dublin, is the earliest known morality play in the English language. The texts of two other religious plays of an early period, *The Play of the Sacrament* and *Abraham's Sacrifice*, are preserved in Trinity College Library, Dublin. It is most likely that these plays were performed in Ireland.

That medieval pageants were popular in Dublin during the 15th century is attested by the *Chain Book of the City of Dublin*, which gives an exact account of the pageant held in 1498. But the first really important dramatic performance in Ireland occurred at Kilkenny on Aug. 20, 1553, when two plays, still extant, written by John Bale (1495–1563), the Protestant bishop

of Ossory, were acted at the Market Cross. With some truth Bale may be described as the father of Anglo-Irish drama, although he was an Englishman by birth and by breeding. He was a prolific writer of moralities, all of which are violently anti-Catholic. His best-known play is entitled *Kynge Johan* (written before 1548). Bale's importance to Irish dramatic development may easily be underestimated because of his brief stay in Ireland—less than a year. Since he introduced to Ireland plays of some topical significance, it may be claimed that these plays had an influence on Irish dramatic literature.

Early Playwrights.—Ireland's first public theater was built by John Ogilby (1600–1676), a Scot, in Werburgh Street, Dublin, some time between 1634 and 1638; and James Shirley (1596–1666), the English dramatic poet, was invited to Dublin to write plays specially for the new theater. Shirley chose an Irish theme for one of his plays, *St. Patrick for Ireland*. This play treats the story of St. Patrick's conversion of the Druids; John Eglinton says of it that "it enables us, far better than a good many of the acknowledged sources of the period, to realise how the Anglo-Irish felt towards their country on the eve of the rebellion." Shirley really set the standard for Anglo-Irish drama, and very soon Anglo-Irish writers were following his example. Ireland gave four playwrights to English literature before 1660: Sir John Denham (1615–1669), Richard Flecknoe (d. 1678), Henry Burnell (fl. 1641), and Henry Burhead (fl. 1645). It is doubtful whether Denham should be claimed as an Anglo-Irish writer for, as an English historian recorded, "before the Foggy Air of that Climate could influence or adulterate his Mind, he was brought from thence." Flecknoe, who wrote many plays, was a very bad poet, and is mentioned with contempt by Pope in the second line of the *Dunciad*. Burnell, it is claimed, was pro-Irish, but his one surviving play, *Landgartha*, shows no trace of it. Henry Burhead's *A Tragedy of Cola's Furie or Lirinda's Miserie* treats of the insurrection of 1641 from the Irish point of view. During the 17th century the Jesuits produced Latin plays in Ireland.

Irish Dramatists.—After the Restoration (1660) Anglo-Irish writers took a very active interest in the English stage. Roger Boyle, earl of Orrery (1621–1679), was the first to introduce the heroic play to England. Thomas Southerne (1660–1746) was highly regarded as a playwright; in his *Oroonoko*, a very popular play, he attempts to expose the evils of the slave traffic.

George Farquhar (1678–1707), though hardly equal to the Irish-educated William Congreve (1670–1729), was scarcely less significant than he. Farquhar's plays were less refined than Congreve's, but they were more human. There is a Rabelaisian gaiety about them which, if not typically Irish, is certainly not English. Farquhar's is real critical comedy. He disliked pretense, and in his plays he took great pleasure in exposing the conventional affectations and deceptions of certain ranks of society and, especially, of the English army officer. Farquhar anticipated the modern domestic drama. He set an example for his contemporaries, who unfortunately were not great enough to profit by it. His best-known plays are *The Recruiting Officer* and *The Beaux's Stratagem*.

Another Anglo-Irish playwright of the period

was Susanna Centlivre (1667–1723). She is best known for her plays, *The Busy Body* and *The Wonder!* Although she was not a great dramatist, William Hazlitt thought highly of her. "Her plays," he wrote, "have a provoking spirit and volatile salt in them which will preserve them from decay. *The Wonder!* and *The Busy Body* are properly comedies of intrigue. Their interest depends chiefly on the intricate involution and artful denouement of the plot, which has a strong tincture of mischief in it, and the wit is seasoned by the archness of the humour and sly allusion to the most delicate points."

Although Richard Steele (1672–1729) is remembered only as an essayist, his plays were at least a minor addition to English dramatic literature; their weakness lay in his sentimentalism. *The Funeral* is the most readable among them; the passage in which he satirizes the undertaker is quite amusing. Hazlitt thought little of Steele as a dramatist, and characterized his plays as "rather homilies in dialogue, in which a number of very pretty ladies and gentlemen discuss the fashionable topics of gaming, of dueling, of seduction, of scandal, etc., with a sickly sensibility that shows as little hearty aversion to vice as sincere attachment to virtue." Steele's *The Conscious Lovers* was a popular success.

Other Anglo-Irish dramatists of this period were Owen Swiney (b. 1680), Samuel Madden (1686–1765), William Phillips (d. 1734), Charles Coffey (d. 1745), Michael Clancy (d. 1760), Charles Molloy (d. 1767), and Henry Brooke (1703–1783).

18th-Century Playwrights.—Oliver Goldsmith (1728–1774) and Richard Brinsley Sheridan (1751–1816) are undoubtedly the best-known dramatists who wrote in English during the 18th century. Both were Irishmen. Goldsmith contributed to every major phase of English literature; he was a poet, a novelist, a dramatist, and an essayist. As Samuel Johnson (1709–1784), to whose circle he belonged, said of him, "he touched nothing that he did not adorn." He wrote two plays, *The Good Natur'd Man* and *She Stoops to Conquer*; he is also the author of a farce called *The Grumbler*. It would not be difficult, if one so wished, to indicate the Irish influence in Goldsmith's writing, especially in *She Stoops to Conquer*, whose boisterous good humor and ridicule of the sentimentalism characterizing the contemporary comedy of tears are undoubtedly facets of the Irish temperament. *She Stoops to Conquer* could have been written only by an Irishman; it is full of that reckless, devil-may-care spirit peculiar to the Irish. Goldsmith, while essentially Irish, does not exhibit intentionally the characteristics which lead to stage Irishism, but passively allows his Irish nature and spirit to express themselves.

Sheridan, like Goldsmith, is so universally known for his contribution to English literature, that it is unnecessary to discuss his work at any great length here. His *The Rivals* and *The School for Scandal* are still acted and enjoyed. Although he did not equal Farquhar for imagery of language or Congreve for style, Sheridan is nonetheless a dramatist of power. In one thing at least he excelled Congreve and Farquhar—he held the follies of his age up to delightful ridicule. The equal of *The Rivals* and *The School for Scandal* as pieces of satirical comment on the mannerisms of middle-class society have never been written before or since. Leigh Hunt

describes him as "a Shakespeare without a heart"; and Hazlitt said of him that "among the comic writers of the last century he shines like Hesperus among the lesser lights." Like most Irish writers, he spent most of his life in England and wrote for an English public.

Arthur Murphy (1727-1805), author of 21 plays and frequently compared by scholars with Sheridan, was a member of Johnson's circle. His best-known play is *The Grecian Daughter*. Essentially a sentimentalist, Murphy tried to write in the true comic vein and, because he attempted the compromise, he failed as a writer. His plays, however, are significant in the history of Anglo-Irish drama.

Hugh Kelly (1739-1777), a great friend of the English actor David Garrick (1717-1779), is the author of *False Delicacy*, a sentimental play which was a great popular success. Kelly was very conscious of Ireland, and wrote *The School for Wives* "in defence of Law and Irishmen." He attempts the Irish idiom, but the result is neither authentic nor artistic.

John O'Keeffe (1747-1833), the popular writer of ballad-opera, romantic comedy, and farce, was born in Dublin. He is the author of at least 77 dramatic pieces, many of which are still remembered. Hazlitt says of O'Keeffe: "He might well be called our English Molière . . . In light, careless laughter, and pleasant exaggerations of the humorous, we have had no one equal to him. There is no labour or contrivance in his scenes, but the drollery of his subject seems to strike irresistibly upon his fancy, and run away with his discretion as it does with ours." His best dramatic piece is *The Agreeable Surprise*. O'Keeffe wrote many interesting songs, of which *Amo, Amas, I Love a Lass* became very popular.

Other Anglo-Irish dramatists of the late 18th century were: Charles Macklin (1697?-1797); Paul Hiffernan (1719-1777), Francis Gentleman (1728-1784), Isaac Bickerstaffe (1735-1812), Robert Jephson (1736-1803), Frederick Pilon (1750-1788), Leonard MacNally (1752-1820), infamous in Irish history as an informer, William Preston (1753-1807), Walley Chamberlaine Oulton (1770-1820), Isaac Jackman (fl. 1777), William Macready (fl. 1780), and Andrew Franklin (fl. 1785).

Irish Dramatists of the 18th Century.—In the 19th century, Irish writers still dominated English dramatic literature. This is not to claim for them that they were great dramatists for, as is well known, the English drama degenerated in that century. Dion Bouicault (1820-1890) was a prominent writer of melodramas. He had a sentimental love of Ireland but, being Anglo-Irish, he was not completely aware of the Gaelic tradition. Consequently the characters in his plays are little better than the stage Irishmen of older plays—slightly better dressed and less wild. Yet, despite his obvious weakness as a playwright, he was superior to most of his contemporaries. His faults were those of his generation—a love of splendor and of melodrama. *The Colleen Bawn* is still remembered and frequently produced. Bouicault spent some time in the United States, and his play, *The Octoroon* (1859), exhibits a picture of life in the southern United States.

James Kenney (1780-1849) was also a prolific playwright, for he wrote upward of 50 plays. He was so popular that Byron, in his *English*

Bards and Scotch Reviewers, makes a slighting attack on him:

Yet what avails their vain attempts to please,
While British critics suffer scenes like these; . . .
While Kenney's "World"—ah, where is Kenney's wit?—
Tires the sad gallery, lulls the listless pit.

James Sheridan Knowles (1784-1862) was considered by some of the best critics to be "the first tragic writer of the age." While that is an overstatement, it may be true to say that he was the author of the best acting plays of the period. *Virginius* is considered his best play—and the character of Virginius was William Charles Macready's most popular portrayal.

Other Anglo-Irish dramatists of the 19th century were: Andrew Cherry (1762-1812), John Till Allingham (fl. 1799-1810), Samuel Lover (1799-1868), Joseph Stirling Coyne (1803-1838), and George Francis Armstrong (1845-1906).

Oscar Wilde (1856-1900) is one of the best known of all the Anglo-Irish playwrights. Although he lived at a period when a new romantic movement in Anglo-Irish literature was being formed, his plays belong to the 18th-century tradition. His mother was nationalistic and had given her son two very Irish middle names, Fingal O'Flahertie, but he ignored Ireland and wrote entirely for a wider public. Wilde's plays belong to the "manners" tradition, and all the characters portrayed by him are taken from upper-class English life. He moved in that society and wrote only about the life which he knew intimately. His best-known play is *The Importance of Being Earnest*. Wilde's weakness as a dramatist, according to William Archer, is that "he treated the art of the dramatist with contemptuous insincerity." He was so in love with style that he put up more than his subject matter could carry. But, for all that, Wilde was a fine dramatist and, as Frank Harris predicted, "he will live with Congreve and Sheridan as the wittiest and most humorous of all our playwrights." If any Irish influence is to be found, it must be sought in the subtle psyche which hovers between the lines, but his contribution to English dramatic literature is no less because of that. Oscar Wilde's plays were the final flowering of the old tradition, for after Wilde's death another Anglo-Irishman, W. B. Yeats (1865-1939), gave English drama a new turn and a new inspiration (see also IRISH LITERARY REVIVAL).

PROSE

To give an idea of the Irish contribution to English prose, one conveniently, if quite arbitrarily, may divide the writers into five general classifications: (1) those who went to live permanently in England, either through economic necessity or because they believed that their roots were there; (2) those who interpreted and explained Ireland to a foreign audience; (3) those who pictured Ireland as a savage and turbulent country and those who added a journalistic touch; (4) those who wrote popular "thrillers"; (5) those who wrote about Ireland out of their own experience.

Authors Domiciled in England.—The only link with Ireland of the writers in the first category lies in the fact that their Irish temperament showed through their work, even though they made no attempt to portray Irish life. To this category belong Jonathan Swift, Richard Steele, Laurence Sterne, Oliver Goldsmith, and many

others. Swift was the greatest of them all. He was the dean of St. Patrick's (Protestant) Cathedral, Dublin. Swift wrote, not for an Irish or an English public, but for himself and for humanity. He was not bound by a narrow nationalism when he wrote his *Drapier's Letters* demanding justice for Ireland; he was fighting for a principle and not for a nation. Every nation may claim Swift, just as all may claim Shakespeare. As H. L. Mencken has shown, Swift had the true universal approach—he began by attacking the Irish as a race of Yahoos, then proceeded to assail the English, and ended by condemning the whole human race. As if to make his judgment on humanity emphatic, he ended his own life in a blaze of insanity. He hated ignorance and stupidity, and he lashed that which he detested with a savage satire. This is certainly one facet of the Irish character.

Swift, no doubt, would ridicule any claim that he was an Irish writer, but he would deny even more indignantly that he was an English one. He had a rebellious and intellectual mind, which diverted Anglo-Irish writers from that sentimental approach to Ireland which damned a considerable portion of 19th-century Irish literature. The liberal attitude, bordering on revolution, of such Anglo-Irish writers as Henry Grattan (1746-1820) and Edmund Burke (1729-1797) must be attributed in a great measure to Swift's influence. If Swift had a contempt for the Yahoos in Ireland, he had also an equal contempt for the Yahoos in every other country. He made Anglo-Irish writers conscious of their individuality, and established for them a tradition which, if not Irish, was just as certainly not English. It is for this reason that he frequently is called the father of Anglo-Irish writing.

Richard Steele, already mentioned as a dramatist, also belongs to this classification, although his sentimentality occasionally compels him to acknowledge his Irish lineage. Steele is recognized with Addison as the writer who did most to establish the essay as a special literary form. *The Tatler*, founded by him in 1709, was the precursor of the modern newspaper. Yet, despite his sentimentality, he must have inherited much of the rebelliousness which is so much a part of Swift. In 1710 he lost his government position because of a satire which he had written, and later he was expelled from Parliament on the charge of seditious libel.

Laurence Sterne left Ireland in his boyhood for England, and later indulged in European travel for his health. Many regard his *Sentimental Journey* (1768) and his novel *Tristram Shandy* (1760) as obscene. *Tristram Shandy* was denounced by Dr. Johnson, Oliver Goldsmith, Horace Walpole, and others, on moral and literary grounds. Some claim that Sterne represents a definite facet of Irish character, though most Irishmen would deny it.

Oliver Goldsmith is easy to recognize as an Irishman, if only because of his casual attitude to life. It is said that he was so sentimentally charitable that he often gave away money which he himself badly needed. Goldsmith has been described as "an inspired idiot," but unjustly so. His foolishness was assumed to guard his integrity—a very Irish trait. Goldsmith's contribution to the development of the essay is considerable, and his *The Vicar of Wakefield* (1766) is a polished novel, though it was written long before the novel-form was completely developed. His

writing has charm, a quality which some ascribe wholly to his racial heritage. Goldsmith achieved greatness.

Other creative writers of prose belonging to this classification were: Roger Boyle (1621-1679), who wrote a long romance entitled *Parthenissa*, Richard Head (1637-1686), Mary Davys (fl. 1756), Henry Brooke (1703-1783), Richard Griffith (d. 1788), William Chaigneau (1709-1781), Charles Johnstone (1719-1800), Frances Sheridan (1724-1766), Elizabeth Ryves (1750-1797), James White (d. 1799), John Corry (fl. 1825), Adelaide O'Keeffe (1776-1855), Thomas Moore (1779-1852), Lady Morgan (1783-1859), James Sheridan Knowles (1784-1862), the Countess of Blessington (1789-1849), and Elizabeth Hardy (1794-1854).

Interpreters of Ireland to Others.—To the second classification (those writers who attempted to explain Ireland to foreigners) belong Maria Edgeworth (1767-1849), Charles Lever (1806-1872), Samuel Lover (1797-1868), William Hamilton Maxwell (1792-1850), and some others. Maria Edgeworth was by far the best writer of this group, but this distinction does not mean that she was a writer of the first importance. She was, indeed, a minor writer, because her range of vision was narrow and because her knowledge of the common people of Ireland was derived merely from casual observation of the peasants on her father's estate. She wrote about Ireland as truthfully as she knew how, and her novels at least give a good picture of the "Big House" and all that it entailed in Ireland. In literature, *Castle Rackrent* (1800) marks the first appearance of an Irish peasantry drawn truthfully instead of their customary misrepresentation as uncouth creatures suffering from semilunacy. Edgeworth portrayed the life of the Irish governing classes and of the rising middle class.

Charles Lever, in dedicating his novel, *Jack Hinton the Guardsman*, stated: "I have no presumptuous expectation of elucidating the mysteries or of solving the difficulties of Irish character, but with the less ambitious object of exhibiting some of their peculiar features, some of their moods of mirth and melancholy, I have ventured in these sketches." Actually Lever elucidated only his own incompetence as a novelist of Irish or any other life. His intention was probably good, but his achievement was meager. In *Harry Lorrequer*, and in his other novels, he catches nothing of the real Irish spirit, and succeeds only in portraying the stage Irishman of older days. Lever's novels are now forgotten, but for a time Lever was the most popular novelist of his day. He is interesting now only as a phenomenon representing the misguided attitude of the less intelligent Anglo-Irish toward their country.

Samuel Lover, though his intention was the same as Lever's, achieved more because of his poetic mind. His best-known novel, *Handy Andy* (1824), is, of course, stage Irish, but the opening chapter is so funny (in a farcical way) that it almost lifts it above mediocrity. The character represented by Handy Andy is an Irish peasant who is constantly making idiotic blunders. The novel was so popular that the word Handy Andy has found its way into the dictionaries.

Depicters of a Tumultuous Ireland.—The writers placed in the third category (those who pictured Ireland as a savage, turbulent country) differ from those in the second class only in de-

gree. The mood in the novels of Maria Edgeworth and Charles Lever was calm. The Irish peasant may have been a blundering idiot, but he was not dangerous. In the novels of the Banims and of Gerald Griffin, however, he is pictured as a savage person with turbulent passions. John Banim (1798-1842) has been described as the Walter Scott of Ireland, because he wished to do for Ireland what the Waverley novels had done for the Scottish people. So in 1823, with the collaboration of his brother Michael (1796-1874), he began the project of *Tales of the O'Hara Family*. The first series of stories was very popular, and further series were issued until the death of John, whose portrayal of the Irish peasant was utterly false and lacked humor. Although Michael Banim wrote the best story of the series, *Crohoore of the Billhook*, he did not write any more after his brother's death.

The novels of Gerald Griffin (1803-1840) were of the same type as those of the Banim brothers, and of no higher quality. In 1828 appeared his *Tales of the Munster Festivals*, written while he stayed with his brother in Kerry. They were so well received that Griffin began a full-length novel, *The Collegians*, which he finished (1829) in London. The Irish revolutionaries of 1848 accepted *The Collegians* as an outstanding novel of Irish life. This is no tribute to their literary judgment, because the novel is melodramatic and false, not only to Irish life but even to nature. The misfortune of Griffin was that he thought that he was writing seriously of Ireland, when he peopled his novel with villains of the deepest dye and heroes of the highest integrity. If *The Collegians* is read today, it is because of its comic appeal. Dion Boucicault turned the story into a highly successful melodrama, *The Colleen Bawn*.

Other Anglo-Irish writers who fit into this category (however awkwardly) were: Sir Martin Archer Shee (1769-1850), Edward Mangin (1772-1852), George Croly (1780-1860), Robert Bell (1800-1867), Miles Gerald Keon (1821-1875), and Kathleen O'Meara (1839-1888).

Writers of Emotional Fiction.—In the fourth classification (those who wrote "thrillers"), Charles Robert Maturin (1782-1824) and Joseph Sheridan Le Fanu (1814-1873) are the most important. While the novels of Maturin, who wrote of the supernatural, had little merit in themselves, they had a great influence on the rising romantic school of France; and even on Sir Walter Scott, who not only reviewed and praised *Montorio* but also imitated *The Milesian Chief* in his own *The Bride of Lammermoor*.

Le Fanu was Ireland's best writer of "thrillers." While other writers in this medium were content to place the scene of their stories in lands where the impossible might be accepted as probable, Le Fanu was more precise and gave definite time, place, and environment to his subject. Le Fanu's stories are highly melodramatic, eerie in the extreme, and reminiscent of the stories of Edgar Allan Poe. They are still very readable. His best novels are *Uncle Silas* and *In a Glass Darkly*.

Other Anglo-Irish writers who may be mentioned here were: Regina M. Roche (1764-1845); Harriet L. Martin (1809-1891); Lady Lytton (1802-1882), author of *Cheveley*, or *The Man of Honour* (1839), a novel in which she made her husband the villain; Marmion W. Savage (1803-1872); Mayne Reid (1818-1883); (Bartholomew)

Elliot Warburton (1810-1852); and Sir George Tomkyns Chesney (1830-1895).

Delineators from Personal Knowledge.—William Carleton (1794-1869) is not only the best writer within the fifth classification (writers about Ireland as they knew it), but possibly the best Irish novelist. Carleton was a Gaelic-speaking peasant and therefore not properly an Anglo-Irishman. No one before or since his time has written so faithfully, so simply, so powerfully, and so well of the Irish peasant. Carleton was born in Ulster, the most historic part of Ireland. He was conscious of Ireland's tradition for the simple reason that he was conscious of himself. He did not write romantically of the country, because poverty at home made him aware of Ireland as it really was. Moreover, he wrote in an authentic Irish idiom, of which the dialogue in the plays of the Irish literary renaissance is only a pale shadow. Carleton's *Traits and Stories of the Irish Peasantry* are brilliantly realistic and are a better picture of the Ireland before the Famine (1845-1850) than anything which may be read in a history book. One of his most admirable characteristics is that he never shrinks before emotion, while at the same time he avoids sentimentality. Probably Carleton's best story is *Dennis O'Shaughnessy Goes to Maynooth*. He wrote many novels, but these are of less interest than his short stories. He turned Protestant that he might receive the patronage of the wealthy, but despite this fact he represented Catholic Ireland more accurately than any other writer. Carleton's stories are not popular, because they are written in a difficult dialect of English.

Other writers who attempted to write about Ireland sympathetically were: Anna M. Hall (1800-1881), Charles J. Kickham (1826-1882), Emily Lawless (1845-1913). None of them, however, rose above the mediocre.

The writers for *The Nation* newspaper, founded in 1842 by Thomas Osborne Davis (1814-1845) and Charles Gavan Duffy (1816-1903), are worthy of mention. Here was the first deliberate attempt to found a school of Irish literature in the English language. Most of the writers for *The Nation* were Anglo-Irish Protestants; and all were extremists who believed in revolution and who rejected, as un-Irish, literature which did not obviously breathe the Irish spirit. The greatest of the writers belonging to this group was John Mitchel (1815-1875). He was, of course, a revolutionary, was transported to Australia as a felon, escaped to the United States, fought for the South in the American Civil War, and edited (1864-1865) the *New York Daily News*. Mitchel's *Jail Journal* is the bible of revolutionary Ireland. It describes his travels to Van Diemen's Land (Tasmania), and its theme is that only through revolution can there be hope of freedom. There are some fine descriptive passages in the book, which is still fresh, even though the ideals for which he fought have largely been achieved.

Thomas D'Arcy Magee (1825-1868) merits mention here for his *History of Ireland*, which often is more creative than factual. He escaped from Ireland in 1848 and became editor for a time of the *Boston Pilot* which was edited later by another escaped rebel, John Boyle O'Reilly (1844-1890).

Lady Wilde (1826-1896) contributed under the name "Speranza" to *The Nation*; she was

very nationalistic, and wrote *Ancient Cures, Charms, and Usages of Ireland* (1890) and similar works. She was the mother of Oscar Wilde (q.v.), who, it must not be forgotten, was a brilliant writer of prose. He wrote some delightful fairy tales but is best known as a prose writer for *The Picture of Dorian Gray* (1891).

Irish writers also contributed extensively to English literature as historians, philosophers, orators, scholars, and journalists. (For Irish prose writers after 1900, see IRISH LITERARY REVIVAL.)

POETRY

Almost every writer thus far mentioned wrote also in verse. Swift was a not inconsiderable poet, as his *Stella's Birthday* and other poems adequately demonstrate. Goldsmith is well known as a poet of importance, and his *The Traveller* and *The Deserted Village* have a permanent place in English poetry. Richard Brinsley Sheridan wrote some pleasant songs, which may be found scattered throughout his plays. John O'Keefe, another playwright, wrote some romantic songs, which are not entirely forgotten.

Nahum Tate (1652-1715) and Nicholas Brady (1659-1726) published in 1696 their joint metrical *New Version of the Psalms of David*. Tate, though elected to the position of poet laureate, added little to the glory of Irish literature, for he was regarded by Pope and other writers of authority as possibly the worst poet who ever held that position.

19th-Century Poets.—It was not until the 19th century, however, that Irish poets, becoming conscious of Ireland and her tradition, wrote best. In Ireland, 1798 was a year of revolution, when many Anglo-Irishmen associated themselves definitely on the Irish side against Britain. As has been shown, they knew little of Gaelic-speaking Ireland until then, but the spirit of nationalism was abroad, and they quickly sensed the importance of uniting themselves completely with every facet of Irish life. First came Charlotte Brooks (1750-1803) with her series of translations, *The Reliques of Irish Poetry* (1789). Then followed Jeremiah Joseph Callanan (1795-1829) and Edward Walsh (1805-1850), who in their translations from the Gaelic reproduced faithfully the wavering rhythm of the Gaelic verse-form. Callanan's best known translation, *The Outlaw of Lough Lene*, begins:

Oh, many a day I have made good ale in the glen,
That came not of steam or malt—like the brewing of men.
My bed was the ground; my roof, the greenwood above,
And the wealth that I sought, one far kind glance from
my love.

But the real link between the Anglo-Irish and Gaelic-speaking Ireland was through music, and it was provided by the *Irish Melodies*, composed between 1807 and 1834 by Thomas Moore (1779-1852). For a century Moore was regarded as Ireland's national poet, but it must be admitted that his reputation was based partly on his brilliance in the world of society. His songs were just sufficiently Irish in a polite way to make them attractive to an English audience. For this reason his influence in England was great and, without question, he contributed much to establish the idea in the English mind that the Irish were not a race of barbarians. More important still, he gave courage and inspiration to Irish writers. Moore's verse is essentially too superficial and facile to have been a major influence, but it was just the thing at that time to

establish the idea of a dignified Ireland with long traditions. Moore knew little of Ireland's history, but he was captivated by the Irish melodies of the 17th and 18th centuries, and he succeeded in putting appropriate words to them which, in a peculiar way, expressed something of Ireland's national spirit and aspiration. He came closest to the true poetic spirit in his *Avenging and Bright* and *At the Mid Hour of Night*. Occasionally he achieved the Gaelic cadence. Moore's weakness is derived from the fact that he was not sufficiently close to the source of Gaelic inspiration.

Verse in "The Nation."—*The Nation*, and the spirit of violent nationalism which it propagated, brought into existence a whole school of verse writers. Men with a talent for writing verses, and many others who had none at all, thought it their duty to express their nationalistic emotions and political ideas in verse. The result of this was that much of the verse of the *Nation* school is too didactic and rhetorical to warrant its classification as poetry. Thomas Osborne Davis (1814-1845) is the best representative of this group. His *My Land* is probably his best piece, but *A Nation Once Again* was his most popular song, and for a long time it was accepted as Ireland's unofficial national anthem. John Kells Ingram (1823-1907), a professor in Trinity College, contributed a rousing song—*Who Fears to Speak of Ninety-Eight?*—to *The Nation*. It was so great a success as a battle cry that the author's conscience disturbed him and he later disclaimed authorship. Another good song writer was John Keegan Casey (1846-1870), who is best remembered for his rebel song, *The Rising of the Moon*. Ireland's greatest ballad, *The Wearing of the Green*, and that other stirring song, *The Shan van Vocht*, belong to an earlier period; no one knows who wrote them. Two other famous Irish ballads, *The Croppy Boy* and *Johnny, I Hardly Knew Ye*, are also anonymous.

James Clarence Mangan (1803-1849), Ireland's most intense poet, also contributed to *The Nation*. However, it cannot be said that he properly belonged to that school of writers. Mangan was a distressed spirit and not a propagandist. His free translations from Gaelic are among the best poems written by Irishmen in English. His *O'Hussey's Ode to the Maguire* has great power, and his *Dark Rosaleen* and *The Woman of Three Cows* are far superior to their Gaelic originals. Probably his best original poem is *The Nameless One*. It is autobiographical and full of passion:

Roll forth, my song, like the rushing river,
That sweeps along to the mighty sea;
God will inspire me while I deliver
My soul to thee! . . .

Go on to tell how, with genius wasted,
Betrayed in friendship, befooled in love,
With spirit shipwrecked, and young hopes blasted,
He still, still strove. . . .

There is little doubt that Mangan was Ireland's greatest poet. Students of Mangan should not miss reading John Mitchel's excellent essay on him, which is included in an edition of Mangan's collected poems.

As translators from Gaelic, Sir Samuel Ferguson (1810-1886), for his *Cashel of Munster*, and Thomas William Rolleston (1857-1920), for his *Clonmacnoise*, should be mentioned. Other Irish poets of some account are: William Dren-

nan (1754–1820), Richard A. Millikin (1767–1815), Charles Wolfe (1791–1823), William Carleton (1794–1869), Samuel Lover (1797–1868), Aubrey Thomas de Vere (1814–1902), William Allingham (1824–1889), Timothy Daniel Sullivan (1827–1914), John Todhunter (1839–1916), John Boyle O'Reilly (1844–1890), Emily Lawless (1845–1913), and Alfred Perceval Graves (1846–1931).

Oscar Wilde resembled Goldsmith in that he succeeded brilliantly in almost every form of literature. His *Hélas!* is a sonnet of great strength, and his *The Ballad of Reading Gaol*, written while he was in jail, holds a permanent place in English poetic literature.

(For the contribution of Irish poets to English literature after 1900 see IRISH LITERARY REVIVAL.)

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IRISH MOSS. See CARRAGEEN.

IRISH MUSIC. From references in early medieval manuscripts it is clear that music played an important role in the life of the ancient Irish. Music-making is mentioned in connection with banquets and ceremonious occasions, warfare, and the casting of spells; and harpers figure in many of the legends. The chief instruments in use in the earliest period were the five- or six-stringed quadrangular harp (as represented on the stone cross at Castledermot, County Kildare), the *tympan* and the *fidil* (stringed instruments played with a bow), and the *piopai* (bagpipe), which was the instrument of the humble folk. Military instruments were the *corn* (horn) and *stoc* and *sturgan* (two types of trumpet). The triangular harp, of which representations are found from the 11th century on, seems to have been introduced into Ireland by the Norse invaders. In its Irish form it was not strung with hide or horsehair but with metal—iron, silver, or bronze; it ranged in size from the small *ocht-tedach* (an eight-stringed instrument used to accompany singing and hung from the girdle) to the larger and more resonant *clairseach*, of which the earliest example extant is the so-called Brian Boru harp (having 30 strings and dating from about the 13th century), which is now in the library of Trinity College, Dublin.

Church Music.—Some evidence exists to show that the ecclesiastical chant was brought to Ireland in the 5th century by St. Patrick himself; but, contrary to the general belief, the chant sung in Ireland was not Roman but Gallican—as practised in Gaul up to the 8th century. Roman chant does not seem to have been introduced into Ireland until the period of the Norman invasion—with the advent of English and continental orders. Though great schools of learning flourished in Ireland from the 6th to the 10th century, and Irish monks were active missionaries all over western Europe, there is little evidence to

support the assertions made by Grattan Flood and others concerning their contributions to the development of western church music; the term "Irish Anglo-Saxon" neume-type, coined by no less an authority than Peter Wagner, is fanciful as far as the Irish element in this neume-type is concerned. The earliest known instance of music notation in an Irish manuscript occurs in the 11th-century Drummond Missal, in which the chant of parts of the mass is indicated by means of neumes—characters of a notation which is the progenitor of our present-day system of music notation. But the Drummond Missal is a Roman missal adapted to local uses, and none of the chants mentioned so frequently in medieval Irish literature have so far come to light.

Whereas, on the Continent, polyphonic music gradually evolved during the early medieval period in the monasteries and churches, in Ireland, the Norman conquest, the clash between the native traditions and those of the invaders, and above all the wars, plantations, and persecutions of the succeeding centuries, combined to deny to church music a normal course of development. The surviving musico-liturgical manuscripts embody a tradition derived from the English, Anglo-Norman, or Continental houses which became established in Ireland from the 12th century.

Harp Music.—Throughout the medieval period, however, the native tradition of music, especially of harp-playing, continued to flourish. Writers such as Giraldus Cambrensis in the 12th century, Dante in the 13th, and Galileo in the 16th pay tribute to the excellence of Irish harp-playing, and numerous masters of the instrument are mentioned in the annals. At the courts of the princes and chieftains, poems composed by the *file* or *bard* were recited or chanted by a *reacaire*, to the accompaniment of an *oirfeadach* (harper). The professional harper ranked, according to the Brehon Laws, as a *bo-aire* (non-noble rent-paying freeman with property), and was the only musician entitled to "honor price"—an additional fine payable by reason of his rank in the event of injury.

Unfortunately we have little information as to the nature of the music played by the harpers. The long panegyric poems recited or sung in the halls of the nobility were so complex in meter that they could not have lent themselves to a musical setting in our sense of the word. It is possible that the main part of the verse was chanted in a monotone, punctuated with cadential melodic inflections in the manner of psalmody, and supported by chords on the harp. Such a method of performance is described as surviving in Mayo as late as the 18th century. As regards the harp music itself, a 17th-century Welsh manuscript in the British Museum (Add. MS. 14905), transcribed from an earlier manuscript and purporting to contain early medieval Welsh harp music, may give some inkling as to its style, since the Welsh and Irish traditions of harp-playing were closely related. Arnold Dolmetsch has deciphered the tablature in which the manuscript is written, and parts of the transcription have been performed and recorded, revealing a style quite unlike that of any music hitherto known; primarily harmonic in its texture, it embraces curious chord-formations and conveys a remote, other-worldly atmosphere by means of methods which seem decidedly impressionistic. However, many aspects of this manuscript are still problematical, and our factual knowledge of

Irish harp-playing is limited to some technical points. The wires, plucked by the harper's long, crooked nails, produced a sweet and tinkling tone very different from the more robust tone produced by gut strings. Owing to the excessive vibration, each string had to be damped before the next was plucked, involving a technique so exacting in the case of fast-moving passages that unless the player started at an early age there was little hope of his becoming proficient. Chords were played downwards, not upwards as today, and there seems to have been much doubling of the melodic line in octaves. In general, the style of playing was fluent, delicate, and highly-ornamented.

Decline of the Harp.—Throughout the wars of the 14th and 15th centuries, and the plantations of the 16th century, the harpers continued to practice their art; and though penal enactments against harpers and rhymers were made intermittently for over three centuries—from the passing of the Statute of Kilkenny in 1367 to the reign of William of Orange—such measures (savagely carried out) were primarily directed against the strolling entertainers, who were often politically active, and not against the harpers patronized by the nobility. After the Battle of Kinsale (1601), however, with the final passing of the old Gaelic order, harp-playing began to decline. The families which had patronized the harpers were for the most part outlawed and their estates confiscated, the planters who immediately succeeded them were no supporters of native art, and harp-playing, from being a privileged calling, fell to being a humble one. In the heyday of medieval minstrelsy, poet, singer or declaimer, and harper were three specialists who combined in the performance of poetry, but now these offices were merged in the one individual. At the same time the esoteric bardic poetry and harp music, unintelligible to the *nouveau riche* as to the simpler folk to whom the harpers had now to turn for support, gave way to popular verse and tuneful music in the folk style. Such music had, of course, coexisted with the earlier bardic art, but from now on it was to become the main vehicle of expression.

Carolan.—With the comparative tranquillity which followed the Treaty of Limerick (1691), conditions became more favorable for the pursuit of music, and the rural gentry, including the few native families who had not been dispossessed, began to cultivate European as well as native music. During this period lived the last and greatest of the poet-harpers, Turlough Carolan (1670-1738), who composed many hundreds of songs, chiefly in honor of his patrons, both Irish and Anglo-Irish, whose houses he visited in the course of his travels. The songs, named after the patrons to whom they were addressed, were sung by the blind poet-composer to an accompaniment on his harp. Gay, humorous, or elegiac, they show great versatility, some being in the traditional style and based on gapped scale-forms, others clearly revealing the influence of contemporary Italian music—such as Carolan would have heard in the drawing-rooms of his patrons. An edition of some of Carolan's songs was published in Dublin by John and William Neale about 1720—the earliest surviving example of music printing in Ireland.¹

¹ A monumental work on Carolan by Donal O'Sullivan, *Carolan, his Life and Times*, including an edition of some 200 of his songs, remains unpublished for lack of funds.

The harpers who succeeded Carolan were ex-cultants only; they continued to dwindle in numbers, and were mostly in straitened circumstances. If changed social conditions were responsible for the fate of the harpers, the decline of the harp itself, which had been so popular an instrument for amateur music-making in the previous century, is explained by the difficulty of its technique as compared with that of keyboard instruments; as well as by the fact that, being a diatonic instrument, it could not cope with the ever-widening range of modulation and of chromaticism during this period—such as was readily available on the harpsichord, the violin, and (when it appeared towards the latter part of the 18th century) the piano.

Belfast Harp Festival.—Before the last vestiges of the harp tradition had died away, an attempt was made to preserve them by the organization of harp festivals—at Granard from 1781 to 1785, and at Belfast in 1792. At the latter festival Edward Bunting, a Belfast organist, noted down the tunes played by the harpers, and these notes were later drawn on for his three-volume *Ancient Music of Ireland*, the first important collection of traditional music. Unfortunately Bunting's method of notation was a primitive one. In the case of songs, since he knew no Irish, the words were not noted with the tune. In the case of harpers' airs, no distinction was drawn between what was sung and what was played, and the reproductions of traditional harp music in his 1840 volume consist almost entirely of elaborate piano arrangements constructed out of purely melodic jottings made many years earlier. Despite its shortcomings, however, Bunting's collection was a notable work for its time, and has remained the chief source of what little information we possess with regard to harp-playing in Ireland.

Folk Song Tradition.—At the end of the 18th century the tradition of folk song was still fully alive throughout the country. Countless airs were in circulation and new poems continually written for the more well-known airs. While Irish remained the language of the vast majority of the people this tradition was able to hold its own, even against the rise of the English ballad—for popular English songs such as those of Charles Dibdin (q.v.) began to have a vogue in Ireland at the turn of the century. But with the suppression of the Irish language in the schools and its gradual abandonment as the vernacular in the second half of the 19th century, the tradition of folk song commenced to suffer the fate which had already befallen the harp music.

Moore's "Melodies."—From 1808 to 1834 the *Irish Melodies* of Thomas Moore (q.v.) appeared serially in ten volumes—melodies from the Bunting and Holden collections to which the poet wedded his admirable lyrics. The *Melodies* achieved an immense popularity, and were instrumental in making Irish songs known to the townsfolk, to whom traditional singing was a closed book, and known in England and abroad. Were it not for Moore's *Melodies*, on the general abandonment of the Irish language the majority of the people would have lost all touch with their own music. But the *Melodies*, elegant, nostalgic, and sentimental, were far removed from the elemental beauty of traditional singing in Irish, which continued to decline in all but the remoter districts.

Folk Song Collections.—Fortunately, a number of collectors throughout the 19th century

worked to place on record what remained of this rich store of song, chief among them William Forde, and John Edward Pigot (whose collections have remained for the most part in manuscript), George Petrie, and Patrick Weston Joyce. The transcription of folk song, however, particularly of that free, unmeasured style so usual with Irish traditional singers, can only be partially successful; for such limited methods of notation as the rank and file of collectors use are inadequate to reproduce the irregular meter, the subtle rhythmic nuances, and the peculiarities of intonation due to the survival of other scale-forms, which are so essential a part of the tradition. The early collectors were too often ignorant of the mode-systems underlying the airs, so that foreign key-signatures and accidentals, and even changes adopted to make the airs "conformable to the laws of harmony" have to a certain extent become incorporated in the corpus of traditional music as taken down in the collections. Careful and scholarly methods, such as those adopted by Martin Freeman in his Ballyvourney Collection (*Journal of the Irish Folk Song Society*, vol. 6), were rarely in evidence. The ideal method of preserving folk song is, of course, by means of recording plus transcription, and this method has been adopted by the Irish Folklore Commission, which houses among its collection of some 3,000 folk songs a large number of ediphone recordings.

Taken all in all, the preserved corpus of Irish folk music is generally believed to be the finest and most varied produced by any nation. Song airs—plaintive, lilting, rugged, or wild and sweeping—shapely narrative airs, religious songs, lullabies, occupation songs, drinking and martial songs, are all to be found, showing the widest range of tonality and the simplest, symmetrical structures as well as chain-structures of the most intricate kind. Incredible as it may seem, there is no specific reference to dancing in early Irish literature, and the dance music—reels, jigs, horn-pipes and "set" dances—is of relatively modern origin.

Clash of Traditions—Anglo-Irish Music.—Irish folk music, unlike that of nations whose music followed a normal course of development, has never been properly assimilated into a broader tradition of art music, due to the chasm—political, social, and religious—which existed for centuries between the spontaneous song in the vernacular which was the natural expression of the Irish people, and the purely English tradition of music-making in the towns.

Ever since the Norman invasion a musical culture had begun to develop in the Pale (the English settlement around Dublin), and other centers of English or Anglo-Norman influence, which had few points of contact with the music of the native Irish. Most of the records are ecclesiastical, and manuscripts such as the 14th-century psalter of Christ Church show the Anglo-Norman tradition of Christ Church and St. Patrick's Cathedrals in Dublin. There seems to have been little creative activity, however, and certainly no counterpart to the school of polyphony which flourished in England from the 15th to the 17th centuries.

Secular music in the towns also seems to have followed an English pattern. It is significant that six of the *Cantilenae* for festivals and other occasions written in the 14th century by Richard Ledrede, bishop of Ossory, for the use

of the vicars choral of Kilkenny Cathedral were directed to be sung to English tunes, and two to French tunes. In Kilkenny, as elsewhere, ordinances were issued forbidding Englishmen to speak Irish, and the music as well as the language of the "wilde Irishrie" would have fallen equally under the ban.

The vicissitudes of Anglo-Irish church music may be understood, in face of the wars of the 14th century, the lax and confused state of religious organization in the 15th, and the wholesale confiscation of monasteries in the 16th. Superimposed on the old conflict between native and foreign religious establishments was now the new conflict which arose with the Reformation. After the Reformation English organists and vicars choral were frequently imported, and two noted madrigal writers of the English school were appointed organists at Christ Church Cathedral, Dublin—John Fermer, who held this post from 1596 to 1599, and Thomas Bateson, who held it from 1608 to his death in 1630. During the Cromwellian period church music was suppressed and organs removed or destroyed, and in some of the cathedrals the services were reduced to those of a mere parish church.

Music in Dublin.—Towards the end of the 17th century, after the turmoil of the Jacobite wars had subsided, conditions became more stable, and Anglo-Irish music entered on a period of prosperity which was to lead to Dublin becoming one of the most musically active cities in Europe. A large number of musical societies came into being, among them the Hibernian Catch Club (the oldest body of its kind still in existence), while concerts for charitable purposes, "benefit" concerts, and performances of ballad opera became the vogue. Crow Street Music Hall was built by the Dublin Academy of Music in 1730 "for the practice of Italian music," and the New Musick Hall, in Fishamble Street, was opened in October 1741. Here George Frederick Handel gave the first of his series of Dublin concerts on December 23 of the same year, and on April 8, 1742, he gave the first public performance of the *Messiah*, amid unprecedented scenes of enthusiasm. Handel's visit was followed by that of Thomas Augustine Arne, who between 1742 and 1744 produced his masque *Comus* and his opera *Rosamund*, and gave the first performances of his oratorio *The Death of Abel* and his serenata *Masque of Alfred* at the Theatre Royal, in Smock Alley.

The eminent violinist Francesco Geminiani had been teaching in Dublin and giving concerts there from 1733 to 1740. His pupil, Matthew Dubourg, led the viceroy's band from 1728 to 1765, and had the privilege of assisting at the first performance of the *Messiah* and at Handel's other Dublin performances. In 1764 Garrett Colley Wellesley, 1st earl of Mornington (father of the duke of Wellington), a composer of church music and of glees, was appointed to the newly-created chair of music in Dublin University.

In the latter part of the 18th century Dublin could boast ten music shops (some of them firms of music publishers), eight harpsichord and piano manufacturers, three firms of instrument makers, and two firms of organ builders. Members of the Anglo-Irish aristocracy formed orchestras and cultivated chamber music, and the patronage of music as a social art was at its zenith. Creative activity was not lacking, the chief com-

posers being Lord Mornington and Philip Cogan.

19th-Century Music.—With the passing of the Act of Union in 1800 and the abolition of the Irish Parliament, Dublin lost most of its significance as a focal center of political and social life, and the patronage of music by the nobility began to wane. In the 18th century Dublin had not only been a hub of musical activity but had attracted eminent musicians from England and the Continent. In the 19th, the chief names to be recorded are those of Irishmen who lived and worked abroad, such as John Field (1782–1837), Dublin-born pianist and composer of nocturnes and piano concertos, who was the first Irishman to gain an international reputation as a composer; Michael William Balfe (1808–1870), also born in Dublin, composer of *The Bohemian Girl*; William Vincent Wallace (1813–1865), born in Waterford, composer of *Maritana* and *Lurline*; and a number of minor figures such as Thomas Simpson Cooke, William Rook, and George Alexander Osborne.

At the same time, a new consolidation of music in Dublin set in with the founding of a series of societies devoted to the regular performance of the orchestral and choral repertory. The earliest of these was the Sons of Handel, founded by Francis Robinson in 1810. This was followed by the Antient Concerts Society, founded by Joseph Robinson, son of Francis, which lasted from 1834 to 1863. At the International Exhibition, Dublin, of 1851 Joseph Robinson assembled a choir and orchestra of no less than 1,000 performers, while in 1856 another society, the Philharmonic, gave the first performance in Ireland of Beethoven's *Choral Symphony*. Later, Joseph Robinson founded the Dublin Musical Society, which gave regular performances from 1876 to 1902 with a chorus and orchestra of about 350. Towards the end of the century the chief figures in the musical life of Dublin were Sir Robert Prescott Stewart (1825–1894), organist at St. Patrick's Cathedral and for a time at Christ Church, and professor of music at Dublin University, who was a prolific composer of organ and church music, and Michele Esposito (1855–1929), an Italian who was appointed professor of piano at the Royal Irish Academy of Music in 1882. Esposito founded the Dublin Orchestral Society, conducting its concerts from 1899 to 1914, and as conductor, composer, pianist, and teacher he dominated music in Dublin for nearly half a century.

In Belfast, the Philharmonic Society, founded in 1874, has been the main source of concert activity, and the society's chorus and orchestra (conducted by Sir Robert Stewart from 1877 to 1890, and from 1913 to 1950 by E. Godfrey Brown) has continued to give an unbroken series of subscription concerts, at some of which major works by composers such as Edward Elgar, Granville Bantock, John Ireland, and Ralph Vaughan Williams have been conducted by the composers themselves.

Stanford, Harty, Moeran.—Sir Robert Stewart's pupil, Charles Villiers Stanford (b. Dublin, 1852; d. London, 1924), and Esposito's pupil, Hamilton Harty (b. County Antrim, 1880; d. London, 1941), proved to be the two most eminent Irish musicians of their time, though both, like their fellow composers earlier in the century, left Ireland at an early age and took up residence in England. Both were knighted for their services to music. Stanford's large output and his work as teacher of a whole generation of English composers belong to the achievements of the Eng-

lish school, but in his editions of *Moore's Irish Melodies* and of the *Petrie Collection of Irish Music*, and in such works as the *Irish Symphony* and the five *Irish Rhapsodies*, he paid tribute to the folk song of his native country. Harty was one of the greatest conductors of his age. As a composer his work is distinguished more for its orchestral virtuosity than for its intrinsic worth, but his tone-poem *With the Wild Geese* and the *Irish Symphony* still survive in the repertoire.

The tradition of Stanford and Harty has to a certain extent been carried on in the work of Ernest John Moeran (1894–1950), a composer of Irish extraction, whose chief works, the *Symphony in G Minor* and the *Violin Concerto*, owe much to the inspiration of Irish folk song and of the landscape and sea coast of County Kerry, where both works were for the most part conceived and written.

Modern Developments.—Due chiefly to the country's checkered history, the general organization of music in Ireland is much behind that of other countries. After World War I the main advances were due to the development of broadcasting. Radio Eireann supports a symphony orchestra of 65 players which gives symphony concerts twice a week in the Phoenix Hall, Dublin, and the broadcasting programs, which are relayed by stations at Athlone, Dublin, and Cork, provide the main source of music for the Irish public. The British Broadcasting Corporation, Belfast, has been an important factor in the revival of music in Northern Ireland, though its symphony orchestra was disbanded on the outbreak of World War II. Apart from broadcasting, recitals by artists of international reputation are given weekly during the season by the Royal Dublin Society. New standards in opera have been achieved by the Dublin Grand Opera Society, which holds two seasons annually, and has brought the casts of the Paris Opera Comique and the Hamburg State Opera to Dublin. The chief music festivals are the Feis Ceoil, a general festival music, and the *Oireachtas*, a festival of Irish music and of the Irish language and literature, both founded in Dublin in 1897; they are the prototypes of the network of music festivals and *feiseanna* held annually throughout the country, particularly in Northern Ireland. Chairs of music exist in Dublin University, the National University of Ireland (at the university colleges in Dublin and Cork), and the Queen's University, Belfast. Dublin has four schools of music (two public and two private) and Cork has one, but Belfast is without any. Concert activity in Dublin is severely handicapped by the lack of a concert hall, but Belfast has its fine Ulster Hall, and Cork its City Assembly Hall. The large music section of the Library of Trinity College, Dublin (Dublin University) is rich in manuscripts, and there is a noteworthy collection of harps, bagpipes, and Dublin-made harpsichords and pianos in the National Museum of Ireland.

The chief names in the modern musical annals of Dublin have been those of Count John McCormack (1884–1945), celebrated tenor; Vincent O'Brien (d. 1946), organist of the Pro-Cathedral; Fritz Brase (d. 1940), founder of the Irish Army School of Music and (1927–1936) conductor of the Dublin Philharmonic Society; and John F. Larchet, professor of music at University College, Dublin. The foremost authority on Irish folk music is Donal O'Sullivan, director of Irish folk song studies at University College, Dublin. Mod-

ern Irish composers include Herbert Hughes (d. 1937), E. Norman Hay (d. 1943), and Carl Hardebeck (d. 1946), the pioneer of the Irish folk song revival; John F. Larchet, Frederick May, Arthur Duff, Brian Boydell, Eamonn O Gallchobhair and Eamonn O Frighil. Conductors include Michael Bowles, music director and conductor, Radio Eireann (1941-1948), and J. M. Doyle, conductor of the Dublin Grand Opera Society and director of the Irish Army School of Music.

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IRISH SCHOOLS AND SCHOOLMEN OF THE MIDDLE AGES.

The Irish monastic schools, dating from the 5th century, were celebrated all over Europe; the lay schools, though playing an important part in spreading learning at home, were not so well known. These two classes of schools were quite distinct all through the literary history of Ireland, and, without interfering with one another, worked contemporaneously. By the 7th century Irish missionaries were scattered all over Europe, and for more than two centuries Ireland maintained her glorious position. Then, in the 9th century, came the invasions by the Northmen, who spread destruction among the Irish schools and monasteries. As Ireland was a group of petty kings, her recovery was quicker than might have been expected. Towards the close of the 11th century, according to St. Malachy and St. Bernard, the old Irish monastic and missionary spirit had become dimmed, chiefly by the Norse invasions. These two saints apparently agreed on the introduction of the reformed Benedictines into Ireland. The Irish postulants, sent to Clairvaux to be trained under the eye of St. Bernard, returned to Ireland as professed monks in 1142 and laid the foundation of Mellifont; within ten years Mellifont founded seven new abbeys. Before the Anglo-Norman invasion of 1170, there were 12 Cistercian monasteries in Ireland, five of which had been founded from England and Wales.

The Anglo-Norman invasion, with the political division of the country between the native Irish and the "adventurers," brought about a division among the new religious foundations into Irish and English houses. The Dominicans were the first of the friars who came to Ireland, and their first house was in Dublin (1224), the center of the Anglo-Norman government. Yet, they soon had Irish foundations—Athenry, founded by Myler Bermingham (1241); Cashel, founded by David McKelly, archbishop of Cashel (1245); and Carlingford, founded by Richard de Burgh (1305). The Franciscan Province was established in Ireland about 1231, but its early houses were established chiefly at the seaports, where English influence was strong. Within 15 years (before 1256) Irish houses stood at Cashel,

Nenagh, Limerick, Multifernan, and New Ross. Between 1285 and 1325 the cleavage between Irish and English houses (Franciscan and Dominican) went on apace, so that (1325) the Franciscans definitely divided their houses. Nenagh, County Tipperary, became the custodian of the Irish friars, with Athlone, Ennis, Clare-Galway, Galway, Armagh, Cavan, and Killeigh as their sister houses. English influence was gradually shrinking, and the Irish houses consequently were adding to their numbers.

Religious Schools and Writers.—These are so numerous that space can be provided for only the most important. One of the earliest writers was Congan, abbot of Cistercian Suir Abbey (about 1150), who wrote the *Acts of Malachy* (archbishop of Armagh), *Epistles to St. Bernard*, and the *Acts of St. Bernard*. It was by his persuasion that St. Bernard undertook to write the *Life of St. Malachy*. Marian O'Gorman, abbot of Knock Abbey, County Louth (1171), wrote the supplement of the famous *Martyrology of Aengus of Tallaght*. John Duns Scotus (13th-14th centuries), the "Subtle Doctor" and Franciscan, has had his life and works edited by Luke Wadding, the celebrated Irish Franciscan, in 12 volumes (1639). Experts, however, are not agreed about the country of his birth, Ireland, Scotland, or England, or even about the year of his birth or of his death. Of the writers of the Cistercian Order, we can mention only a few principal ones. Matthew O'Heney, of Holy Cross Abbey, County Tipperary, afterwards archbishop of Cashel (1192-1206) and papal legate (1194), wrote, among other works (since lost), a *Life of St. Cuthbert, Bishop of Lindisfarne*, and several *Epistles to Pope Celestine III*. Henry Crump, doctor of divinity and professor at Oxford (1390), belonged to the Abbey of Baltinglass, County Wicklow (1382), and was a prominent opponent of John Wycliffe (Wiclif), English religious reformer. Donchadh O'Daly, abbot of Boyle, County Roscommon (d. 1250), "was an eminent bard, and in the hymnal species, was superior to all the poets of his time." Felix O'Dullany, of Jerpoint Abbey, County Kilkenny, governed the diocese of Ossory, 1178-1202, endowed the abbey, and was buried in a tomb on the north side of the high altar—where many miracles are said to have been wrought. Maurice MacGibbon, abbot of the Cistercian monastery of Nenagh (Maigue), Limerick (founded in 1148 from Mellifont), was appointed archbishop of Cashel in 1567; he had a strenuous time in Elizabeth's reign, and escaped to Oporto, Portugal, where he died in 1578.

The 15th century saw an enormous production of Irish annals, chronicles, and philosophical and theological treatises. John of Ireland (c.1460), a Dominican friar, published a *Manipulus Florum*, a "Collection of the best flowers out of all the Sacred Writers, proper for all subjects." One Malachy O'Lachnain, a secular priest of Killa-loe, wrote an *Antiquum Missale* consisting of psalms, offices, and lives of saints, in Gothic character and illuminated (MS. in Trinity College, Dublin). In the 16th century the *Whole Philosophy of John Scotus* was published by Maurice O'Fihely, a Franciscan and archbishop of Tuam, who also published a *Dictionary to Holy Scriptures* (Venice 1603). A James Walsh, an Irishman who became a divinity student at Oxford, translated into English the writings on Ireland of the celebrated Giralduus Cambrensis (Giraldus or Gerald de Barri Cambrensis). Writers on

philosophy and commentators on St. Thomas's writings continued in the 16th century. The latest was Edmund Tanner, bishop of Cork (1574-1579), who was the author of *Dissertations on the Summa of St. Thomas*.

Annals.—These are the materials for a real history of Ireland. The principal ones now remaining in the Gaelic language are those of *Tighernach*, *Ulster*, *Loch Cé*, *Inisfallen*, *Boyle*, *Connacht*, *Donegal*, and the *Chronicon Scotorum*. Those of *Clonmacnois* are lost in the Gaelic version, but a translation into English is extant (1627). Besides these, we have in Latin those of *Multifernam*, *Grace*, and *Clyn*. *Tighernach* died in 1088, but his *Annals* have been continued down to 1407. His compilation is a remarkable instance of the great learning and devotion to scholarly pursuits of the Irish laymen of the 10th and 11th centuries, and affords evidence of a cultivation and diffusion of literature which, at so early a period, would do honor to the history of any country. Fragments of these *Annals* are in the Bodleian and Trinity College, Dublin, libraries; they were edited by Whitley Stokes (1830-1909) in the *Revue Celtique*, vol. 16. In order of time, the next compilation of ecclesiastical and general historical records, is that of *Inisfallen*, about the year 1215; the monastery in *Loch Lein* (Killarney) dates from the 6th century, so that the compilation may have been begun about the 10th century. These *Annals* were reproduced in facsimile from the original manuscript (Rawlinson B. 503, in the Bodleian Library, Oxford) by the Royal Irish Academy, Dublin, in 1933. The *Annals of Boyle*, part in Irish and part in Latin, begin with the Creation and reach down to 1253; the Cistercian monastery at Boyle was founded quite near the ancient Irish monastery. The *Annals of Ulster* gathered the abundant materials that had accumulated since *Tighernach's* time down to 1498, the date of the death of the compiler, *MacManus*; *W. M. Hennessy* edited in four volumes, Irish and English (1887-1901), the manuscripts in Trinity College, Dublin, the Bodleian Library, Oxford, and the British Museum. The *Annals of Loch Cé*, near Boyle, County Roscommon, are known as a continuation of the *Annals of Tighernach*; the manuscript in Trinity College, Dublin, was edited and translated by *W. M. Hennessy* (London 1871). The *Annals of Connacht* begin with the year 1224 and end in 1562, but the years 1394-1397 are missing; the only copies extant are in Trinity College, Dublin, and the Royal Irish Academy. They are probably a fragment of the *Annals of the O'Duigenans of Kilonan*, County Roscommon. Of the history of the *Chronicon Scotorum*, by the celebrated *Duald MacFirbis*, little is known; three copies are extant—one in Trinity College, Dublin, and two in the Royal Irish Academy. *MacFirbis* was the last of a long line of lay historians and chroniclers of Tireragh, County Sligo. The compilation, which includes the period between 375 and 1135 A.D. and is one of the most authentic collections, is from more ancient annals (ed., *W. M. Hennessy*, London 1866). The only known copy of the so-called *Annals of Clonmacnois* is an English translation of the year 1627, in the quaint style of the Elizabethan period. It seems to be a faithful rendering of the original Irish version, and comes down to the year 1408. It was translated into English in 1627 by *Conell Mageoghagan* (ed., *D. Murphy*, Dublin. 1896).

The *Annals of the Kingdom of Ireland by the*

Four Masters are the most important of all in point of interest and historical value. Michael O'Clery, the chief of the Four Masters, and inspirer of the great national literary work, was born near Ballyshannon, County Donegal, in 1580, of a family of hereditary scholars, lay and ecclesiastical; he probably was educated by the Franciscans there, and became a member of the order. In 1627 he visited the various Irish religious houses and other repositories of ancient Irish manuscripts and laboriously copied all the important tracts dealing with the ecclesiastical and civil history of the country. The work begins with the Deluge, Anno Mundi, 2242, and ends in 1616 A.D. It covers about 4,500 years of a nation's history in 1,100 quarto pages. No perfect copy of the autograph is known to exist. Trinity College, Dublin, has a portion from 1335 to 1603, and T.C.D. has a portion from 1170 (imperfect) to 1616 (ed. *J. O'Donovan*, Dublin 1851). Surviving Gaelic literature amounts in volume to many times that of classical Rome, and was an important factor in European literary history.

We can deal only briefly with the Latin *Annals of Ireland*. We know the name and station of some of the writers, and approximately their date. *Clyn's Annals* were written by John Clyn, a Franciscan friar in the convent of that order in Kilkenny; in 1336 he was guardian of a Franciscan house founded by James, earl of Ormonde, in his earldom of Carrick. His description of the plague of 1348 is simple and pathetic, and the concluding lines of his *Annals* are also pathetic: "I leave parchment for continuing the work, if haply any man survive." He died the next year. From the Scottish invasion of 1315 to the plague of 1348 may be considered the period of *Clyn's Annals*. (See *Annals of Ireland* by John Clyn and Thady Dowling, with *Annals of Ross*, edited by R. Butler, Irish Archaeological Society, Dublin, 1849). The *Annales Hiberniae* were compiled about 1537-1539, probably by James Grace, who is said to have belonged to the Priory of St. John, in Kilkenny; they begin at 1074 and end at 1370 (the manuscript, in Trinity College, was published by the Irish Archaeological Society, Dublin, 1842). For an account of the enormous output of literature and chronicles by Irish scholars it must suffice to refer the reader to *Eugene O'Curry's Lectures on the Manuscript Materials of Ancient Irish History* (1860). The authors of most of the other Anglo-Irish Annals are unknown; they express no personal feeling and record events almost mechanically. A brief list of the Annals will suffice: *Clonenagh* in Laoighis; *Cong*, of the 10th century, an account of Irish families, kings, and Irish saints; *Mellifont*, 1142-1500; *Multifernam*, West Meath, Franciscan Monastery, 1245-1274; *Nenagh*, County Tipperary, Franciscan, 1336-1370; *Duiske*, County Kilkenny, Cistercian Monastery, written in 1512 and continued to the suppression of the monasteries about 1540.

Lay Schools.—Nearly all the professional physicians, lawyers (brehons), poets, builders, and historians were laymen. A large proportion of the men chronicled in the Irish Annals during the whole period of Ireland's literary pre-eminence, as distinguished in art and general literature, were laymen. The old schools taught by Christian ollaves or doctors—laymen—the representatives of the druid teachers of ancient times, still held their ground. There were several classes of these schools. In the bardic schools were taught poetry, history, and general Irish

literature. Some were for law and some for other special professions. Edmund Campion, in 1571, saw schools for law and medicine where "they speake Latine like a vulgar tongue, whereat they begin as children and hold on sixteene or twenty yeares." The position of the bards was well established in the earliest tradition of the Irish polity. In the Anglo-Norman period, after the invasion of 1170, the Normans built monasteries where education was given as in the English monasteries, but the Irish chieftains continued their private schools of law, medicine, poetry, and history, and their output of Gaelic literature. Those schools were hereditary, passing from father to son, and lived on wherever independence was retained or where the invaders were assimilated. The later bardic schools of poetry date from about the 13th to the middle of the 17th century; they produced a plentiful supply of manuscript material, but very little has been published. The time is not yet ripe for a proportioned survey of it. One of its most remarkable features is that it deals with a continuous Irish historical present; the same manner of life, the same mode of thought, were apparent in the 18th as in the 8th century—the Gaelic Catholic civilization. Every chieftain had an annalist or bard in his school of poetry and history; we have a long list of the chief bardic families. The greater chiefs had each, severally, a law school, and we know the names of the great lawyers for the interpretation of the ancient Brehon law. The training course for a lawyer lasted 20 years. Each chief had a doctor hereditary in the family, and again we have the names. These schools were supported by grants of lands from the Irish chiefs.

A few words about the English policy in education in Ireland will not be out of place. In 1320 Pope Clement V made an effort to erect a *Studium Generale* in Dublin as a center of higher studies for the whole of Ireland. The project was doomed to failure from the start, as the pope did not realize Irish conditions and that a university in Dublin would be confined almost exclusively to the English settlers. In the Tudor period (from 1485) the shadow of impending change fell upon the Irish schools, yet at this time the O'Clerys of Donegal (the family of the principal member of the "Four Masters"—the Annalists) kept three schools—for literature, history, and poetry. During the Reformation period, Henry VIII tried in 1537 to set up an English school in Dublin as "the Irish language kept many of his Irish subjects savage and wild," but the scheme ultimately failed as funds were not available. Yet, in 1540 Henry suppressed three religious houses: the Convent of the Canonesses of St. Augustine of Grace Dieu (north County Dublin), founded in 1190 for the education of the young ladies of the Pale in the English tongue; the Cistercian Abbey of St. Mary's; and the Cathedral Chapter of Holy Trinity (Dublin), where the boys of the Pale were educated. The lord deputy and council of Ireland had recommended in vain that they be spared, as there were no other schools to take their place. The confiscation of Irish and Anglo-Norman Catholic schools went on apace. In the reign of James I a few schools in the Irish-speaking districts managed to continue, especially in Galway, where a flourishing academy for classics and general education was kept by the celebrated John Lynch, afterwards bishop of Killala. In 1615 James' commissioners visited the school, which they found full of scholars from all parts

of Ireland and "highly efficient," yet they ordered it to be closed. In spite of the penal laws many schools struggled to exist, but ended up as "hedge schools."

Medical Schools.—In the pre-Christian period in Ireland the Druids ranked next in importance to the kings. They were priest-physicians and teachers. In the early Christian or monastic period medicine was taught and practiced by the monks in their schools. The great libraries of Britain and the Continent contain numerous manuscripts that show that the monks were diligent students of medicine. As early as the 6th century the Irish monks had established on the Continent *Hospitalia Scothorum* (Irish Hospitals). Medicine and surgery were carefully studied in Ireland from the very earliest times. The kings and the great Irish families had physicians attached to their households whose office was, as in other professions, hereditary. In the 10th century the physicians, like the rest of the community, took family names: there are abundant notices in Irish writings of the household hereditary physicians of most of the leading chiefs. The stipend usually consisted of a tract of land and a residence, free of rent and tribute, together with certain allowances. The Irish medical manuscripts were written on vellum. The members of each medical family had generally their own special book, which was handed down from father to son. Other books were copied from time to time, so that the chief medical families had libraries containing the medical knowledge then available. The oldest medical manuscript in Ireland appears to be one copied in 1352. The manuscripts between the 13th and 18th centuries, preserved in the libraries of Dublin, London, and Oxford, form a collection of medical literature in the Irish language which is probably the largest in existence in any one tongue. There are 80 medical manuscripts in the Royal Irish Academy, Dublin, some of which have been published.

The physics and psychology of Aristotle were the foundation on which the medical physicians raised the structure of their study of the pathology of body and mind. Further, the school system of the scholastics was taken over *in toto* by the medical schools and, as the formal logic of the schools was adopted in the disputations and writings of the medical faculties, the study of scholastic logic was an essential part of the medical discipline. This new medical learning was introduced into Ireland in the 14th and 15th centuries. The Irish doctors took over as a whole the medical system and tradition of their continental brethren. This explains the presence in Irish medical manuscripts of philosophic treatises that were considered by the continental doctors necessary to the scientific study of medicine. There are Gaelic versions of the standard textbooks, and it is known that some of the Irish medical men had studied medicine outside Ireland. The number of extant Irish texts is considerable, but the study of this medico-philosophical literature has been almost entirely neglected up to the present time. There are manuscripts of the type in Trinity College, Dublin; British Museum; National Library, Dublin; National Library, Scotland; Bodleian Library, Oxford; University of Edinburgh; and the Royal Irish Academy. Under James I these hereditary practitioners were stripped of their holdings and followed their liege lords to foreign lands; many of them never returned to their native land but gained fame abroad.

Art Schools.—In the 5th century St. Patrick kept in his household artists in several mediums. The pastoral staff was of wood and of small size—practically a walking stick with an ornamental case. Its manufacture seems to have formed a regular branch of Irish monastic art. We still preserve beautiful specimens of these richly adorned staffs—such as that of Clonmacnois (in the National Museum, Dublin) and that of Lismore (in the Castle). Two processional crosses, that of Cong (National Museum) and that of Clogher (at Monaghan), were of oak covered with bronze designs, enamels, filigree work, and precious stones, and date from the 12th century. The two-handled chalice of Ardagh (National Museum), of about the 8th-10th century, was composed of gold, silver, bronze, lead, enamel, glass, amber, and mica. The relic shrines, preserved, are similarly precious. Some of the leather satchels for carrying those shrines around are also preserved. The Irish artists nowhere displayed more manual dexterity, ingenuity, and invention than in the art of copying and adorning religious manuscripts; they are the fairest specimens of calligraphy and illumination now extant. We need only mention the celebrated *Book of Kells* (8th century). As to church building, the two finest monuments of Irish Romanesque style are the Cathedral of Clonfert (County Galway) and Cormac's Chapel, on the Rock of Cashel (County Tipperary). The latter marks the zenith of the Hiberno-Romanesque style (1134). In artistic iconographic stone-carving of monumental high crosses, Ireland was especially rich; about 55 still remain from the 8th-10th centuries. In the 10th and following centuries Celtic crosses attained a high degree of beauty and wealth of ornament. In music, the Irish teachers continued their art in spite of the Danish invasion. In 1185, Giraldus Cambrensis, the famous Anglo-Norman writer on Ireland, stated that Irish music had "a singular charm, quick and lively, and withal sweet and blithe in tone." He mentioned especially the harp, that was probably used in the monasteries as part of the ritual. He stated that "the bishops, abbots, and saints of Ireland were wont to carry their harps with them on their journeys, and that the sounds they drew from them were a source of pious delight." Again, he stated that the Irish harpists "are incomparably more skilful than those of any other nation I have ever seen." For centuries after the time of Giraldus, music continued to be cultivated uninterruptedly in the Irish schools, and there was an unbroken succession of great professional harpists which continued to the 17th century, and after.

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IRISH SEA, the body of water between England on the east and Ireland on the west. It is connected with the Atlantic Ocean on the north by the North Channel, and on the south by Saint George's Channel. The north shore of Wales and the southwest shore of Scotland are washed by this sea. It is almost circular in form, about 140 miles north and south, and the same east and west. Morecambe Bay is the largest arm of the sea on the coast of England; and on the west coast, Dublin and Dundalk bays are the most important. The Isle of Man lies in the center of the sea. The ancients termed the Irish Sea *Oceanus Hibernicus*.

IRITIS, i-ri'tis, inflammation of the iris of the eye. There are several types of the disease, depending upon the cause. Rheumatism and syphilis frequently result in plastic iritis, and the contraction of a fibrinous exudation deforms the iris. In spongy iritis, a fibrinous coagulum takes place in the anterior chamber of the eye. Catamenial iritis may occur at menstrual periods.

IRKUTSK, ir-kōōtsk', city, Soviet Russia, capital of the Irkutsk Region, in the southern part of Asiatic Russia, on the right bank of the Angara River 45 miles from the southwest shore of Lake Baikal. Prior to the Revolution of October 1917, it was the residence of the governor general of eastern Siberia and the seat of an archbishopric of the Greek Orthodox Church. A great fire in 1879 destroyed many important buildings, including the library and museum of the Siberian section of the Russian Geographical Society. There are a university, founded in 1918, and several colleges. Varied manufactures include machinery for the Lena gold fields. The city was founded in 1652 as a center for trade in fur and skins with Siberia, and commerce with China increased its importance. John Ledyard (q.v.), the American traveler, described Irkutsk as a settlement of some 2,000 houses; he was arrested there on Feb. 24, 1788, on the instructions of Empress Catherine II (Catherine the Great). Between 1918 and 1921 the city was the scene of much disturbance. A Czechoslovak force fighting on behalf of the Allies occupied it on July 8, 1918; it was soon lost to the Bolsheviks, but was recaptured on August 17. Admiral Aleksandr Vasilievich Kolchak, counterrevolutionary leader, retreated to Irkutsk after the fall of Omsk in 1919; here he was forced to resign on Jan. 4, 1920, and on February 7 he was captured and shot by the Bolsheviks. Pop. (1939) 243,380.

IRNERIUS, ir-nēr'i-ūs, or **WARNERIUS**, or **GUARNERIUS**, Italian jurist: b. Bologna, 1050?; d. ?1130. Regarded as an authority on the Justinian Code, he wrote *Summa Codicis*, the first systematic treatise on Roman law.

IRON, Ralph, the pen name of Olive Schreiner (q.v.).

IRON. The chemical element iron, methods of iron manufacture, the origin, distribution, mining, and handling of iron ores, the metallography of iron and steel, and the iron and steel industry are discussed under the following headings:

- | | |
|---|---------------|
| 1. Chemical Element Iron and Its Properties | } Manufacture |
| 2. Older Processes and Direct Reduction (Sponge Iron) | |
| 3. Cast Iron | |
| 4. Pig Iron | |
| 5. Wrought Iron | } Iron Ores |
| 6. Malleable Iron | |
| 7. Origin of Iron Ores | |
| 8. Iron Ore Districts of the United States | |
| 9. World Supplies | |
| 10. Mining and Handling of Iron Ore | |
| 11. Iron and Steel, Metallography of | |
| 12. Iron and Steel Industry in the Western Hemisphere | |

1. CHEMICAL ELEMENT IRON AND ITS PROPERTIES.—The term iron has such a variety of applications in referring to the many alloys of which iron is a base, that it is difficult for the average person to use the term correctly. Iron has been known from prehistoric times. Molding records, decaying monuments, fabulous legends, and sibylline traditions have been examined, but no one has found out how man discovered the utility of iron, or how man first learned the art of extracting the metal from its ores. The name iron undoubtedly was applied to this metal after man had discovered how to extract or separate it from its ores, and the name for iron differed in every language. The term *ayas* in Sanskrit was shared in common with copper by the Latin and Teutonic languages—Latin, *oes*; Gothic, *aiz*. Apparently the term *ayas* finally assumed the special meaning of iron, being derived from the older name of copper. The Gothic *eisarn* (iron) is considered by J. and W. Grimm as a derivative form of *aiz*. *Eisarn* is changed in Old High-German to *isarn*, later to *isan*, the Modern German, *eisen*, while the Anglo-Saxon *isern* leads to *iren* and iron. In its true sense, the term iron refers to the absolutely pure form of the metallic element iron. As iron has never been produced in the chemically pure form, pure iron is merely a metallurgical curiosity. There are several methods of producing forms of iron which are nearly pure and are available commercially. These commercial forms of nearly pure iron are available to the research scientist, enabling him to carry on many different tests in an effort to determine the mechanical, physical, and chemical properties of nearly pure iron. The following account of the characteristics of nearly pure iron are based upon the results of this research. All references are to the various forms of commercially pure iron and not to the many alloys of which iron is the basic element, such as iron casting, pig iron, malleable iron, etc. These forms of iron contain large percentages of carbon and other elements; they are highly alloyed ferrous products which differ chemically and physically from the commercial forms of nearly pure iron.

The early history of iron is inextricably tied up with mythology, religion, and folk lore. The first iron to be used by primitive man was unquestionably meteoric iron (essentially an alloy of iron and nickel) which, aside from having potentialities as a tool or weapon, possessed two characteristics that impelled those primi-

tive people to worship it. First was the desire of the people to have as a fetish some object of supernatural origin to be the abode of a spirit and thereby give to its possessor power over such a deity. Second, this fetish object must be readily transportable so that in times of stress or danger early man could have a god that was close at hand. Meteoric iron, a heaven-sent material, was an ideal fetish, because it undoubtedly came from the sky, and as a celestial visitor it was a suitable home for the spirit.

Biblical references to iron are a measure of its antiquity. There are 90 references to this metal in the Old Testament, but only 7 in the New, tending to indicate that after the birth of Christ, iron had become so common that it no longer merited unusual consideration.

Production of Iron.—With perhaps the exception of the meteoric source and a very few portions of the earth's crust, metallic iron is found in chemical combination with other elements, principally as an oxide, mechanically mixed with certain amounts of earthy matter (chiefly sand or clay), and occurring in deposits known as ore. The operation of reducing the ore to a metallic iron is known as *smelting*. The extraction of iron from some of its ores (smelting) is easily carried out, as it is only necessary to mix ores with charcoal and create a brisk fire to cause the metal to separate. If the ores are pure, the metal itself will be relatively pure and require very little if any refining. Iron produced by this process results in a pasty and unfused mass which is easily worked under the hammer and may be wrought into useful forms.

Ores.—Iron ores, from which the metal may be extracted, occur in large deposits in every continent of the globe; however, smelting operations can be carried on only in localities where iron, fuel, and flux can be assembled at moderate transportation costs. The only important varieties of ore are hematite (Fe_2O_3), magnetite (Fe_3O_4), limonite (hydrated Fe_2O_3), and siderite (FeCO_3).

Reduced Iron.—The oldest and most widespread commercial method of extraction is by reduction of iron oxide. Such oxides may be concentrated magnetite ore, with byproducts such as mill scale or partially oxidized iron scrap borings, turnings, etc. Reduction is accomplished at temperatures between 900°C . and 1090°C . in an atmosphere rich in carbon monoxide or pure hydrogen. Nearly pure iron has been produced by numerous processes involving the use of crushed ore and removal of the oxygen from the iron by use of carbonaceous or reducing conditions. This method is not new, as primitive man produced iron in this manner. Iron produced by the reduction process is often referred to as a sponge iron, from its spongelike character. Sponge iron has been almost exclusively used as a melting stock for electric furnaces as a raw material or base for the production of high grade steels. It is also a raw material for the production of an iron powder or iron in a finely divided state. Such iron powder may be used in the fabrication of iron or iron alloy parts by the technique of powder metallurgy, whereby iron powder or alloyed iron powders are cold pressed in steel dies to the shape desired. This cold-pressed shape is then heated, sintering the pressed powder together to form a solid resembling a cast or forged part.

Carbonyl Iron.—A very pure form of commercial iron may be produced by allowing carbon monoxide gas to pass over sponge iron at suitable temperatures and pressures, forming an iron carbonyl that is liquid at room temperature. The iron carbonyl decomposes to form again both the metal and carbon monoxide at higher temperatures and atmospheric pressure. Iron produced from iron carbonyl is nearly pure, containing less than 0.0007 per cent carbon and less than 0.01 per cent oxygen. Other elements may not be present in quantities that can be determined. The relative purity of this form of iron makes it ideally suited for the manufacture of magnetic cores. In powder form it is also used in the field of powder metallurgy.

Electrolytic Iron.—Electrolytic iron, prepared by electrolytic deposition, is as pure a form of iron as may be obtained by any method. There are two processes used for making iron by the electrolytic process. In one the anode consisting of metallic iron is arranged so that the electric current flows from the iron anode, which furnished the iron, through an electrolyte composed of ferrous chloride (FeCl_2) and then to a revolving rod or sheet which forms the cathode. The pure iron is deposited on the cathode in the form of a tube or sheet and can later be stripped from it. In another process iron is deposited from a solution obtained by leaching iron sulphide ore. A graphite anode permits the current to enter the solution. This is the only known commercial method of producing iron from sulphide ore. Electrolytic iron, when deposited by the usual methods, is brittle because of the hydrogen present in the iron. In this brittle form it can easily be broken and made into a powder iron. By heating the deposited electrolytic iron to a red heat (annealing), the hydrogen is driven off, and the iron becomes ductile, the ductility increasing with the temperature of annealing or with repetition of the operation. Electrolytic iron may be used in powder form for the powder metallurgy fabrication field, or remelted and cast into useful forms, or cast into blanks or ingots for rolling or forging. As a raw material, it may be used as a base for the manufacture of high-grade ferrous alloys.

COMPOSITION OF ELECTROLYTIC IRON

	Per cent
Carbon	0.006
Phosphorus	0.005
Sulphur	0.004
Silicon	0.005
Total impurities	0.020

Ingot Iron.—Ingot iron is the product of the basic open-hearth furnace, the careful manipulation of which produces a commercially pure iron. In order to keep the iron as free from impurities as possible, only carefully selected raw materials are used. The practice used in melting and refining is about the same as for ordinary steel practice with the basic open-hearth process; during refining, however, further purification is carried out by adding a pure ore to the heat in order to oxidize the small amounts of silicon, manganese, and carbon left in the bath. The molten metal is then degasified, tapped into ladles, and cast into ingot molds, forming cast ingot iron. Ingot iron is also known

as open-hearth iron. It is used in sheet metal and plate work, such as roofing, pipe, and tanks; as a base for vitreous enameling; and in electrical work, since its electrical resistance is low because of its purity.

A TYPICAL ANALYSIS OF INGOT IRON

	Per cent
Carbon	0.012
Manganese	0.017
Phosphorus	0.005
Sulphur	0.025
Silicon	0.002
Total impurities	0.061

Physical Properties of Iron.—Since the structure and properties of iron are strongly influenced by the kind and amount of impurities present in the different forms produced by the various commercial methods, it should be appreciated that the following discussion concerning the nature of iron and its behavior is based on information made available from research carried out with the various forms. Complete agreement as to the exact values for the various properties and characteristics is not to be expected. The following physical properties are averages of many different tests made by different specialists on the available commercial forms of pure iron:

PHYSICAL CONSTANTS OF IRON

Chemical symbol	Fe
Atomic number	26
Atomic weight	55.85
Density, grams/cm. ³ at 20°C. (68°F.)	7.87
Density, pounds/inch. ³ at 68°F. (20°C.)	0.284
Atomic volume	7.1
Melting point, ° C.	1535
Boiling point, ° C. (760 mm. pressure)	3000
Specific heat, calories/gram/° C. at room temperature (equals Btu./pound/° F. at room temperature)	0.1075
Latent heat of fusion, calories/gram.	65
Latent heat of fusion, Btu./pound	117
Linear coefficient of thermal expansion /° F. at room temperature. $\times 10^{-6}$	6.6
Linear coefficient of thermal expansion /° C. at room temperature. $\times 10^{-6}$	11.9
Thermal conductivity, calories/cm. ² /cm./° C./second at room temperature	0.19
Electrical resistivity, microhm-cm.	9.8
Modulus of elasticity (tension), pounds per square inch $\times 10^8$	30

Nuclear Structure.—The nucleus of the iron atom consists of 26 protons and 30 neutrons equal in number to the atomic weight of iron (56). The proton is the basic constituent of atomic nuclei having a positive charge. The nucleus of the iron atom therefore carries a 26-fold positive charge, and is surrounded by enough electrons (26; unit of negative electricity) to make the atom electrically neutral. The ratio of the weight of the iron atom (56) to the number of neutrons (30) is 0.536. This quantity is an indication of nuclear stability, which is quite large for iron.

Arrangement of Electrons.—The 26 outer electrons are believed to be distributed on four shells as follows: the inner *K* shell, 2; *L* shell, 8; *M* shell, 14; and the outer *N* shell, 2.

Crystallographic Properties.—Iron is found to crystallize in the cubic system with the possibility of existing in two different arrangements

of the atoms; body-centered cubic for alpha, beta, and delta iron, and face-centered cubic arrangement for gamma iron. The body-centered cubic arrangement of atoms consists of 9 atoms, 8 atoms of which form the 8 corners of a cube, with the 9th atom located at the center of each unit cube. The face-centered cubic arrangement consists of 14 atoms, 6 of these being placed in the center of each of the 6 cube faces.

Transformation Points.—Iron, upon solidification and during subsequent cooling to room temperature, undergoes polymorphic changes or alterations in crystal structure. The changes that occur during cooling from the temperature of solidification to room temperature reverse themselves upon heating. The temperatures at which these polymorphic changes occur have been called "critical temperatures," and are designated by the notation A2—A3—A4. Upon heating, the changes occur at 770° C. for the A2 transformation, 910° C. for the A3, and 1390° C. for A4. Below the A2 transformation temperature (770° C.) iron exists in the alpha, body-centered form, between A2 and A3 in the beta, body-centered form, between A3 and A4 in the gamma, face-centered form, and between A4 transformation and the beginning of melting, in the delta, body-centered form. These polymorphic changes are influenced by changes in pressure at a constant temperature just as the changes in melting and boiling are affected by changing pressures. The properties of one polymorphic form of iron will differ from those of another form. For example, gamma iron can dissolve up to 1.7 per cent carbon, whereas alpha iron can dissolve only 0.03 per cent carbon. These remarkable polymorphic changes that occur during heating and cooling of iron account, in no small measure, for the importance of iron as the "master metal," and contribute largely to the heat treatment effects obtained in the operation of hardening of steels.

Electrical Properties.—The most predominant electronic property of metals is electrical conductivity. The explanation of this property is based on the conception that electrons are furnished the iron, through an electrolyte com-free to move throughout the atomic space-lattice at definite energy levels while holding the positive atomic nuclei together. This freedom of movement of electrons provides a means by which a stream of electricity may be conducted through a crystal by the application of an external potential which accelerates the electrons and causes them to flow in the direction of the positive side of the applied potential. Electrical resistance arises from any condition which tends to hinder this transfer and flow of electrons. The electrical resistance of iron is greatly influenced by impurities and by previous thermal and mechanical treatment, so that the reported values for iron are often discordant. A value of 9.8 microhm—cm. at 20° C. is considered by H. E. Cleaves and J. G. Thompson to be the best approximation for the resistivity of iron. The electrical resistivity of iron, like other metals, changes with temperature. Cold deformation of the iron crystals increases the resistivity.

Magnetic Properties.—Nearly pure iron is a most important magnetic substance and is capable of being magnetized very highly when surrounded by a solenoid of wire conveying an electrical current, the iron forming a solecore.

Magnetization persists only while the current is flowing, for upon cessation of the current, iron retains a negligible amount of magnetism. It is this property of temporary magnetization that makes iron a valuable material for cores of electric magnets or solecores, the action of which plays such an important part in telephone, telegraph, relays and instruments' of all kinds. It is also used in the manufacture of magnetic chucks, clutches, and separators of all kinds. The magnetic properties of iron, like the electrical properties, are sensitive to small changes in treatment and amount of impurities. A continual decrease in magnetic properties occurs when heating iron until the A2 transformation 770° C. takes place, at which point iron loses its magnetic properties, becoming nonmagnetic; however, it regains its magnetic possibilities upon cooling again. The temperature at which this loss of magnetism occurs is known as the *Curie Temperature*, one of the most interesting phenomena exhibited by the metal iron.

Mechanical Properties of Iron.—Commercially pure iron is a relatively soft, ductile metal which cannot be hardened by any heat treatments such as are applied to steels. Owing to its high ductility, it can be formed cold by drawing, rolling, stamping, or bending. Any cold forging or forming is accompanied by an increase in hardness and strength. Impurities and alloying elements such as carbon greatly alter the mechanical properties of iron. The element carbon, more than any other constituent, affects the properties of iron, and changes iron to steel. The following indicates the mechanical properties that can be expected from ingot iron which has been annealed to produce a dead soft condition:

Tensile strength in lbs. per sq. in.....	38,000
Yield strength in lbs. per sq. in.....	19,000
Ductility as measured by percentage elongation in 2 in.....	43 to 48
Per cent reduction of area.....	70 to 77
Hardness as measured by the Brinell Hardness Test	67 Brinell

The mechanical properties of iron may be increased by cold deformation or cold work-hardening. The tensile strength of ingot iron may be increased to approximately 100,000 lbs. per sq. in., with the Brinell hardness increased to approximately 220 Brinell, by subjecting it to severe cold working. Cold working is the only practical way in which the mechanical properties of commercially pure iron may be changed, as this metal is not susceptible to hardening by heating and quenching as is the case with such iron-carbon alloys as steel. The only heat treatment that is carried out with commercially pure iron is that of annealing after cold work-hardening. Annealing may be done by heating the cold work-hardened iron to a temperature range from 650° C. to 750° C. followed by cooling to room temperature. This treatment will restore the original soft, ductile condition of the iron.

Corrosion of Iron.—The metal iron is silverlike in color, and when freshly polished or burnished acquires a bright metallic luster. Iron under ordinary conditions at room temperature in air tends to rust. The tendency of iron to corrode in air is its most unfortunate property. The fact that the structure of iron, un-

less protected, tends to disintegrate into a red powder causes us to spend millions of dollars annually to avoid destruction of objects of iron. But the process of rusting, although familiar, is not simple. It is not merely the union of oxygen with iron to form the oxide Fe_2O_3 . The rust is a hydrated oxide of varying composition, to which we may assign the formula $3\text{Fe}_2\text{O}_3 \cdot n\text{H}_2\text{O}$. Pure iron tends to rust slowly; the greater the amount of some impurities present, the more rapidly the process takes place. Furthermore, iron does not rust in the absence of water; even if water is in contact with it, the process is not particularly rapid if that liquid is pure. Aqueous solutions of electrolytes cause the action to go on with great rapidity, as anyone can observe by watching the conduct of iron in contact with sea water. The protection of iron from rusting involves merely the formation over the surface of a film which is impervious either to air, or to water, or to both. To attain this end, the metal is coated with zinc, tin, terne metal or vitreous enamel; or the film of magnetic oxide, formed while the iron is cooling (after hot rolling), may be left on the iron.

Polished iron, when heated above room temperature in air or steam, will oxidize by the formation of layers of iron oxide with an aggregate composition intermediate between FeO and Fe_3O_4 . Thin oxide films forming between a temperature range of 190°C . and 375°C . furnish the so-called *tempering colors* used by the old-time workmen in tempering steel. The thickness of oxide film is comparable with the wave length of light, and the films furnish a series of interference tints with the dominant color altering as the film thickens. The colors vary from a pale yellow at 190°C . through blue to a gray color at 375°C . As the layers of oxide get thicker, a dark, smooth film is formed, until at a high temperature (1000°C .) a blistering effect occurs. When iron has been exposed to a temperature around 700°C ., the smooth, surface film of oxides will offer good resistance to subsequent rusting at room temperature.

Oxides of Iron.—There are three definite oxides formed from the combination of iron and oxygen: iron monoxide, or ferrous oxide, FeO ; ferrosic oxide, Fe_3O_4 ; and ferric oxide, Fe_2O_3 . Ferrous oxide, FeO , may be prepared in a number of ways, many of which involve some form of oxidation of iron at some elevated temperature between 200°C . and 700°C . When prepared by gaseous reduction, FeO is a black powder. Ferric oxide, Fe_2O_3 , occurs in the native form as hematite (ore), and if prepared artificially, ferric oxide is the end product of the oxidation of iron, of its lower oxides, or hydroxides, and many of its salts. Ferrosic oxide, Fe_3O_4 , is a black, magnetic oxide which occurs in nature as the mineral magnetite, one form of which is termed *lodestone*. Fe_3O_4 may be prepared, artificially, by oxidizing iron at a high temperature, either in air or in steam, or by heating carbonate of iron to 350°C ., in a current of carbon dioxide.

Although the compounds of iron are of far less importance than the metal and its alloys, there are numerous essential industrial processes in which compounds of iron are employed. The compound salts of iron belong to two classes: the ferrous compounds, and the ferric compounds. The former are generally green in color. They may be changed rather readily to

the ferric salts by oxidizing agents, and even tend to undergo that change spontaneously when they are exposed to air. Ferric compounds are usually red or yellow in color and are stable in air, although they may be changed by energetic reducing agents to the ferrous varieties.

Ferrous Salts.—The most common ferrous salt is the sulphate $\text{FeSO}_4 \cdot \text{H}_2\text{O}$, sometimes called green vitriol or copperas. It is obtained in large quantities as a byproduct in the process of galvanizing or tinning iron and steel to remove scale. The metallic surface to be coated is cleaned by dipping the metal into a bath of sulphuric acid. The action of the acid on the scale produces most of the sulphate, and the superficial attack of the metal produces the remainder. The sulphate accumulates in the bath from which it may be obtained by crystallization. It is a green crystalline salt which tends, upon storage, not only to effloresce, but to oxidize to the brown, basic ferric sulphate. It is used in the manufacture of inks, in dyeing, as a disinfectant, and in water filtration.

Ferric Compounds.—Ferric chloride, $\text{FeCl}_3 \cdot \text{H}_2\text{O}$, is a yellow salt, which gives, by hydrolysis, an acid reaction when dissolved in water. In an alcoholic solution, tincture of iron, it is used as a medicine. Ferric oxide, Fe_2O_3 , is much used as a cheap but effective red pigment (Venetian red), and, in another form, as the most expensive rouge. Its color varies with its purity and fineness.

Iron salts have long been used in inks. A common variety is that made by mixing a solution of ferrous salt with tannic acid. Ferrous tannate is soluble and nearly colorless, and the ink is given bluish color by addition of a dye.

Complex Cyanides of Iron.—A yellow crystalline salt, potassium ferrocyanide, $\text{K}_4\text{Fe}(\text{CN})_6 \cdot 3\text{H}_2\text{O}$, is obtained from heating nitrogenous organic matter, potassium carbonate, and iron together, and then leaching the fused mass with water. By the action of strong oxidizing agents, such as chlorine, upon solutions of potassium ferrocyanide, a red salt, potassium ferricyanide, $\text{K}_3\text{Fe}(\text{CN})_6$, is obtained. Prussian blue, $\text{Fe}_4(\text{Fe}(\text{CN})_6)_3$, may be prepared by such treatment of potassium ferrocyanide, and has considerable use as a pigment and in laundry bluing.

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2. OLDER PROCESSES AND DIRECT REDUCTION (SPONGE IRON).—

"Older processes" and "direct reduction" are treated together, because from the earliest times until about 1350 A.D. all the iron made in the world was produced by the direct reduction of iron from iron ore in a single step or process.

Coal being unknown, charcoal was the universal metallurgical fuel of ancient man, and iron ore was directly reduced to metal by local smiths in small, charcoal forge fires in the countries bordering on the eastern shores of the

Mediterranean Sea nearly a thousand years before the Periclean age in Greece. Many different names were given to the product of this direct process, one among others being the term "sponge iron."

One of the earliest references to the term "sponge" in connection with iron is that of the Greek historian Diodorus Siculus of the 1st century B.C., who mentions the production on the island of Elba of pieces of iron "resembling great sponges" by the melting of pieces of iron stone (iron ore) in special furnaces. The burning charcoal in these furnaces not only furnished the required temperature, but, as we now know, also served as the reducing agent needed to combine with the oxygen of the ore.

The term "sponge" was appropriate to the product obtained by heating iron ore in a charcoal fire, as the resulting porous, spongy mass of partly reduced iron mixed with melted ore and gangue looked very much like a large black sponge. The ore itself, due to its impurities (gangue), had a lower melting point than the metallic iron, and the porous, spongy appearance of the lumps or sponges pried from the bottom of a charcoal forge fire resulted from the fact that some of the unreduced ore and mineral impurities melted together, forming a slag which ran out leaving holes in an unmelted network of solid, freshly reduced metallic iron.

Earliest Production of Iron.—The first intentional production of iron probably occurred about 1500 B.C. in the area between the Black and Caspian seas, on the southern slope of the Caucasus Mountains. By 1350 B.C. the art of iron smelting had spread from this area throughout Mesopotamia, Palestine, and Egypt, and soon thereafter to the entire Mediterranean World.

Up until the middle of the 14th century, when the first iron smelting furnaces which were large enough and supplied with a sufficiently powerful air blast to be capable of producing molten or "pig" iron came into use in Europe, all metallic iron made by man was produced by the direct process, that is, sponge iron made directly from ore.

Naturally occurring forms of iron oxide (iron ore) are always more or less contaminated with foreign mineral matter, which taken together as a whole are called gangue. The gangue in iron ore is usually made up of siliceous or clayey matter, with the addition at times of some lime-bearing minerals. The object of all iron producers is to reduce the iron oxide part of the iron ore to metallic iron and separate it from the gangue. In the early direct processes, the charcoal forge fire was not hot enough to melt the reduced iron, which consequently remained solid; it was hot enough, however, to melt some of the unreduced iron ore and gangue. This mixture of gangue and unreduced ore, which had a very much lower melting point, was known as cinder, and most of it ran out from the lower part of the fire at the side or bottom of the hearth. The product was a porous lump (loupe) of soft reduced iron; it always contained some entrapped cinder, which was largely eliminated by reheating the loupe to a high forging temperature in a second forge fire and then hammering the metal, at first gently all over to consolidate it, and then more vigorously to pound the molten cinder out of the hot, malleable mass. Several reheatings were usually required.

In the blast furnace, the separation of the

metal from the slag or cinder is accomplished much more simply, as the temperature is high enough to melt the iron as well as the gangue. The metal, being heavier and not mixing with the molten slag, collects in a layer at the bottom of the blast furnace from which it can easily be tapped off separately from the lighter slag.

The Earliest Iron Furnace.—The earliest iron-producing furnace was probably a simple vertical hole a few feet deep, dug in the steep clay bank of an open hillside. The hole was uncovered at the top and had a draft hole located at the bottom to face the prevailing wind, furnishing the "blast" for burning the charcoal. It was soon learned, however, that a stronger blast than that obtainable in this way was necessary for effective operation, and hand or foot operated bellows were used to furnish it. It is said that, even before the advent of the Iron Age, bellows had been developed in Egypt for melting copper and bronze and precious metals in clay pots or crucibles by blasting charcoal piled around them with air to make the charcoal burn faster.

To obtain a temperature high enough to melt iron in a shaft furnace, charcoal must be burned with a forced draft or blast. The early bellows were neither large enough nor powerful enough to do this. Instead, every country developed its own variation of the charcoal forge and made iron by direct reduction of the ore without melting. All of these forges worked on the same principle, that of adding iron ore to a charcoal fire blown by a forced draft of air that was usually supplied by bellows.

Medieval Forges.—An English adaptation of the direct process was carried out for several centuries in the forests of the Weald near London in forges known as bloomery hearths. These consisted of circular mounds built up of alternate layers of charcoal and ore and covered with clay. When a mound was completed, it was blasted with air until the charcoal was burned out. The cinder melted and was tapped off to one side. After the mound had partly cooled down, it was broken open, and a mass of 300 to 400 pounds of reduced sponge iron was removed from the bottom.

In a commoner European variation of this process a smaller batch of ore was treated in a charcoal fire on an open brick or stone hearth, the charcoal being blown similarly with a bellows, usually through a hole in the rear wall of the hearth. Charcoal and ore were fed to the fire for several hours, either in alternate layers or as a mixture, depending on the local practice, until a 50- to 75-pound lump or loupe of reduced iron formed in the lower part of the burning charcoal. After pokers had been used to pry it out, it was picked up by tongs, still white hot and dripping with cinder, and carried to an anvil to be hammered together into a rough bar or bloom as previously described. After reheating and hammering or forging in order to remove as much cinder as possible, these early sponge iron blooms were fashioned into finished bars not greatly different in appearance, chemical composition, and physical properties from modern wrought iron bars, which are made from pig iron either in the old-fashioned puddle furnace or by the modern Aston process.

A well-known early forge of this type was used for centuries on the island of Corsica, becoming known as the Corsican forge. A still

commoner type, known as the Catalan forge, was used throughout Europe; it is supposed to have originated in Catalonia, Spain. There were many other local variations of this same charcoal hearth process in different parts of the ancient and medieval world. In the United States, modern types of the Catalan forge with water-cooled hearth side plates, power-driven blower engines, preheated air blast and stacks to carry away the smoke and waste gases were still in operation as late as 1901. This was probably the last of the Catalan forges, but even as late as 1945, in parts of Africa, India, and China, small amounts of iron were still made locally in tiny blast furnaces, a few feet high, fed with ore and charcoal and blown by hand-worked bellows or hollow-log, piston air pumps.

Advent of Blast Furnace.—By the 17th century, the blast furnace process introduced two centuries earlier had already showed its superiority as a producer of iron over the earlier charcoal forge or bloomery processes owing to its much greater productive capacity. This was true even though the pig iron it produced still had to be further refined in "finery" forges to make wrought iron, and the two stages together required more fuel. The blast furnace continued to be the pre-eminent producer of iron from iron ore, neither the older charcoal hearth and bloomery forge processes nor the more modern direct reduction sponge iron processes having at any time accounted for more than a very small fraction of the total iron produced. In modern times over 99 per cent of the world's production of metallic iron is reduced from its ores in blast furnaces.

Modern Definition of Sponge Iron.—Since the early 1920's the term sponge iron has come to mean not only directly reduced sponge iron in the historical sense, but almost any kind of iron or steel made directly from ore, with the exception of pig iron made in a blast furnace. Technically, sponge iron is usually defined as iron ore or oxide reduced to metal without fusion; that is, a direct ore reduction or sponge iron process is one in which solid particles of metallic iron are obtained directly from solid particles of ore without any melting of either the ore or the iron.

Theoretical Advantages of Direct Reduction Processes.—Despite the almost universal acceptance of the blast furnace for smelting iron from its ores, interest in the possibility of producing iron direct from the ore never died out; renewed interest was particularly apparent in the 1920's and again in the early 1940's. Different direct reduction or sponge iron processes have been proposed over the years, and hundreds of patents have been issued on them throughout the world. A considerable number of them have progressed past the paper stage and have been actually tried out experimentally. This continuing attempt on the part of technical men in many different countries to develop an economical direct or sponge iron process has been due to the fundamental theoretical advantages of direct production. These are: first, the simplicity of producing a finished product from the ore in a single step; and second, the lower fuel requirement of the single step process, particularly if advantage is taken of carrying it out at low temperature with a gaseous reducing agent. Iron oxide is rapidly reduced to iron by carbon monoxide at temperatures between 1800° and

2000° F., and by hydrogen at temperatures as low as 1000° F. This contrasts with temperatures of well over 3000° F. which occur in normal blast furnace practice.

The theoretical heat requirement for the gaseous reduction of ore to metal without melting, in the solid state, is also much lower than when the reduction takes place by contact with hot carbon. This fact is well known from blast furnace operation. A smoothly running blast furnace operating with low fuel consumption is recognized as one in which the ore has been nearly completely reduced to sponge iron by the gases in the upper part or shaft of the furnace, before it has reached the lower, incandescent melting zone in the hearth. If the low temperature, gaseous reduction or sponge iron reaction in the shaft of the blast furnace is incomplete for any reason, the unreduced portion of the ore must be reduced by hot carbon in the hearth, thus increasing the fuel consumption of the furnace. It may be said, therefore, that efficient sponge iron formation is necessary for good blast furnace practice.

Commercial Sponge Iron Processes.—Outside of the very limited iron powder field, only two direct reduction or sponge iron processes are known to be in commercial production, and both are in Sweden. The older, the so-called Sieurin process, has been in operation at Hoganas, Sweden, since about 1910. A very pure ore containing 71 per cent iron is packed in tall clay pots in alternate layers with fine coal and burnt lime. The pots are stacked in a ceramic-type kiln fired with producer gas made from low-grade coal and heated to a temperature of from 1800° to 2000° F. for a period of several days. After cooling, the pots are opened and the loosely consolidated round cakes of sponge iron are removed and compressed to a specific gravity of about 5. The product contains over 95 per cent iron and is used by steel makers, particularly in Sweden, for the production of the higher grades of cutlery, tool and gun steels.

The other commercial Swedish process is known as the Wiberg process. First proposed in 1918, a 2-ton per day commercial unit was placed in operation at Sodafors in Sweden in 1930 after considerable preliminary experimental and development work. Its capacity has subsequently been enlarged. In this process, pure magnetite concentrates are first sintered into lumps and then charged into a low shaft furnace through which hot carbon monoxide gas is passed. The hot gas reduces the ore. The spent gas, containing the carbon dioxide formed by the reduction reaction, is withdrawn from the upper side of the furnace and circulated through hot coke in a separate unit to reduce the carbon dioxide again to monoxide. The coke is kept hot electrically, and the revived spent gas, after passing through it, is returned to the furnace to reduce more ore. About a fourth of the gas is burned in the upper portion of the furnace to preheat the ore.

In 1943, the Wiberg process produced between 7,000 and 8,000 tons of iron per year, while the Hoganas plant was said to be producing about 15,000 tons.

In the early 1930's, the Germans developed a Norwegian adaptation of the Wiberg process, called the Norsk-Staal process, which they operated for a number of years on high-grade, imported Swedish ore. It was reported to be tech-

nically successful and to have produced up to 30,000 tons of sponge iron per year, but its costs were too high to permit it to compete with the ordinary methods of steel production.

Another German direct process using a high-temperature rotary kiln is known as the Krupp-Renn process. This was developed to treat lean, high silica ores. The ore was fed, mixed with coal into one end of the kiln, and heated high enough to reduce and melt both iron and gangue. The result was a mixture of globules of iron, suspended in a viscous mass of gangue which was granulated by running it into water. This was subsequently crushed and the iron separated by magnetic means. Some slag stuck to the iron, so that the magnetic separation was not perfect, and the product had to be treated further.

Rotary Kiln Processes.—A number of rotary kiln sponge iron processes have been tried in the United States. The United States Bureau of Mines did a great deal of work on the reduction of iron in rotary kilns in the 1920's. The United States Steel Corporation tried out a process using three rotary kilns in sequence (one each for heating, reduction, and cooling) known as the Hornsey-Wills process, in the middle 1920's at Lorain, Ohio. In 1945, the Bureau of Mines placed in operation at Laramie, Wyoming, a large experimental rotary kiln which had a design capacity of 50 tons per day. The rotary kiln processes have had trouble producing a high-grade product due to contamination of the sponge iron by the gangue in the ore and the ash and sulphur in the coal usually used as a reducing agent.

A few other direct reduction processes have attained more or less prominence in the technical press since 1930. W. H. Smith of Detroit, Michigan, was active in the development of a process about 1930 which was carried out in vertical retorts through which a mixture of ore and carbonaceous reducing material descended slowly. The retorts were externally heated, the ore attaining a temperature between 1600 and 2000° F. Its capacity was limited by the necessity of transferring the entire heat requirement for reduction through the walls of the retorts. The inventor died before the process was commercialized. In 1943-1944 the Bureau of Mines experimented with a plant in Texas designed by Julian Madaras, using natural gas as the reducing agent. The natural gas was first partially converted into carbon monoxide and hydrogen by heating it with steam to give it more reducing power. The Madaras process was a batch process designed to reduce lump ore by passing hot reducing gases under pressure through it at approximately 1800° F. The pressure on the gas was varied between 35 and 65 pounds per square inch to aid the penetration of the reducing gas into the ore. Twelve-inch lumps of ore were approximately 85 per cent reduced after about 16 hours in the reducing chamber.

Still another process was one developed by G. H. S. Anderson in the 1920's, units of which were said to have operated successfully in Japan in the 1930's. In this process a mixed layer of ore and coal was spread on a large revolving circular hearth and heated from above by closed muffle flues. In this way, the oxidizing combustion gases used to supply the heat required for reduction were prevented from coming into direct contact with the ore being reduced.

Another process known as the Brassert-Cape

process was tried out during World War II in a commercial size plant at Warren, Ohio, designed to produce 100 tons of sponge iron per day. This process utilized the hydrogen content of hot coke oven gas as the reducing agent and was distinguished from other previous or contemporary processes by its much lower operating temperature, from 1100° to 1250° F. instead of from 1600 to 2000° F. At this low temperature only the hydrogen in the coke oven gas reacted with the ore. The reducing unit was a 12-hearth Herreshoff furnace. Magnetite concentrates the size of coarse sand were fed into the top of the furnace and moved slowly downward by revolving rabble arms over each of the 12 hearths, as hot coke oven gas passed upward countercurrently. The gas was cleaned after passing through the furnace and returned to the steel mill for use as fuel. The plant attained only about one third of its designed capacity and was no longer operated after the war emergency was over, although its product was used successfully in the production of a number of trial heats of electric furnace steel.

Requisites for Successful Sponge Iron Process.—To be successful, a sponge iron process must produce a high-grade product, one containing a minimum of undesirable impurities. Nearly everything except metallic iron constitutes an undesirable impurity. Because direct reduction without melting offers little opportunity for eliminating gangue from the ore, a high-grade ore or ore concentrate must be used as raw material, lower-grade ores being left to the blast furnace. Since the development of new wet magnetic concentrating methods in the 1930's, iron ore concentrates of much higher purity than ever before have become available. American reserves of magnetic iron ore suitable for concentration are also known to be much greater than was formerly believed to be the case. These two factors are so favorable to sponge iron production that they lead one to predict that development of the direct production of metallic iron from its ores without fusion will be continued in the United States until a commercially successful process is achieved.

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3. CAST IRON.—Gray cast iron (synonym: gray iron) is the most widely used of all cast materials. The term "gray iron" is derived from the characteristic gray fracture, as opposed to the lighter colored fractures of most steels. The presence of the dark graphite flakes in gray iron is responsible for its unusual fracture color or shade. Gray cast iron castings range in size from heavy machinery parts weighing well over 100,000 pounds to small castings such as piston rings weighing but a few ounces. This material finds wide usage because it combines useful engineering or service characteristics with ease and

economy in overall production. Large users include the automotive industry (major casting tonnage, cylinder blocks), municipalities (gas and water piping), machinery builders, agricultural implement manufacturers, chemical and oil industries, building and furnishing industries, railroads, steamships, and so on, down to the cast iron skillet in the kitchen. In all these fields it has been challenged by other materials—the skillet is made also in aluminum and in steel. Competitive challenges have been met by improved classes of gray iron. In some cases other materials have proved superior, while in many cases gray iron has supplanted other materials.

Foundries where iron castings are made are found in nearly all cities where the population is 50,000 or over. There are about 2,880 iron foundries in the United States. Their capacities vary from small shops melting perhaps 10 tons per day, to large establishments whose daily melt may exceed 250 tons. The total melting capacity of the iron foundry industry is about 26 million tons per year, castings production about 17 million tons.

Beside iron castings, other metals and alloys such as steel, aluminum, magnesium, brasses, bronzes and others are made in cast as well as in wrought form. The casting industry is in total the fifth largest of all manufacturing industries.

The metal industries (cast and wrought) have developed tremendously since the advent of the Industrial Revolution. Manufacture, agriculture, transportation, and communication have grown concurrently with developments in metals and in their applications. Thus the material aspects of social development are connected in marked degree to developments and progress in the metals industry.

Although archaeologists have found that ornamental iron castings were made by the Chinese about 500 B.C., it was not until the 14th century that commercial iron castings were made in Europe. Their first large-scale usage was for cannon balls, initiated at Menningen, Germany, in 1388. The first casting made in the United States was a cooking kettle, made at Lynn, Mass. in 1642. The industry soon spread among the colonies. Most early castings were intended for domestic use, such as cooking ware, stove parts, pumps, and the like. Metal used was pig iron (itself essentially a gray iron) direct from the blast furnaces. The cupola, in which most gray iron is melted today, was developed in commercial form by an Englishman, John Wilkinson, in 1794. The first cupola in America was one built in Pennsylvania about 1820.

Like steel, gray iron is an alloy or series of alloys containing various percentages of iron, carbon, and other elements. As distinguished from steel, gray iron has a high total carbon content and low ductility. The greater proportion of the carbon in gray iron is in the form of graphite.

Defined technically, cast irons are alloys of iron and carbon containing so much carbon that as cast they are not appreciably malleable. Usually from 1.7 to 4.5 per cent carbon is present, and, in most cases, an appreciable percentage of silicon. All cast irons are eutectiferous alloys, and are classified commercially as follows: (1) pig iron (blast furnace product; see section on *Pig Iron*); (2) white cast iron (a hard, not graphitized product); (3) malleable cast iron (see

article 6, *Malleable Iron*); (4) gray cast iron.

Gray cast irons as cast have combined (cementitic or carbide) carbon not in excess of an eutectoid percentage (usually approximately 0.8 per cent carbon). The usual total carbon percentage is in the range 2.70 to 3.60 per cent. Percentages of graphitic or free carbon may range from about 1.90 to possibly 3.50 per cent.

All gray irons contain considerable percentages of silicon, usually in the range 1.0 to 2.8 per cent. They also contain appreciable percentages of manganese and phosphorus, and small percentages of sulphur.

A considerable tonnage of gray iron, called alloy iron or alloyed gray iron has elements such as nickel, chromium, copper, molybdenum, etc., added to enhance or modify its mechanical and manufacturing properties.

"Semisteel" is a term which has been used for gray irons of actual or supposed better mechanical properties than the average gray irons. Material sold under such a name does not have the ductility and high impact characteristics of steel—it is true gray iron. In better informed engineering circles the term "semisteel" is obsolete. A wide variety of strength classes is available under gray iron specifications. The engineer wisely and safely prescribes the strength class required, and is not misled by misnomers, such as semisteel and various trade names which sometimes imply that a true gray iron product is something else.

Usual gray irons are magnetic, and of ferritic base. Some very highly alloyed irons, called

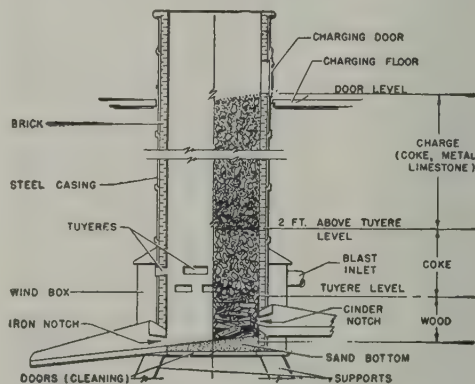


FIG. 1. Vertical section through cupola furnace for producing gray iron.

austenitic irons, are practically nonmagnetic and have markedly enhanced resistance to numerous corrosive fluids.

MANUFACTURE

Melting Practice.—Gray Iron (*Cupola Practice*).—The major portion of the gray iron produced in this country is melted in the cupola furnace. The cupola is a vertical, cylindrical type of furnace consisting of a steel shell lined with fire brick (Fig. 1). The furnace is charged through a charging door which is located 15-20 feet above the bottom plate. At the lower end of the furnace is the wind box, or air chamber, as shown in the diagram. Air enters the cupola through the tuyeres. The cupola is a simple and an economical melting unit because the fuel and

the metal are in intimate contact with each other.

Fuel, metal, and flux are charged through the charging door of the cupola. Coke is charged first and the initial charge is known as the bed charge. Iron is then charged upon the coke. Alternate layers or charges of coke and iron are introduced into the cupola. Where flux is used it is charged on the coke. The coke bed is ignited by means of kindling wood or an oil torch. The bed charge of coke usually extends from 28-50 inches above the top of the tuyeres.

The charge of iron depends upon the capacity of the cupola. The cupola sizes are referred to as the inside diameter of the lining of the cupola. Cupola sizes may range from 18 inches in diameter to over 100 inches. The size used for ordinary commercial practice varies from 42-84 inches in diameter. The rated capacities on these sizes are from 5-25 tons of metal melted per hour.

The quantity of coke used depends upon the quantity of metal charged. The bed charge is a definite height above the tuyeres. Consequently, this portion of the coke goes in by volume instead of by weight. The succeeding charges of coke are in direct proportion to the metal charged. This proportion varies from one part of coke to 7-12 parts of iron.

The metal charged into the cupola consists of gray iron scrap and pig iron. Steel scrap is also used where strength of the finished casting is important as steel scrap increases the strength by modifying the composition of the iron. The proportions of gray iron scrap, pig iron, and steel scrap are governed by the type of casting. It is customary to find considerable difference in mixture of metal used, even among foundries making the same class of work.

Limestone is used as a flux in cupola operation. The purpose of the flux is to form a slag with the dirt, impurities in the metal, and the coke ash. Fluorspar (calcium fluoride) is sometimes used as a fluxing agent in combination with the limestone. The purpose of the fluorspar is to thin the slag and also to aid in the removal of sulphur, although correct proportions of limestone will ensure a fluid slag and some sulphur removal. Various forms of soda ash are used as fluxes, particularly in the ladle. Proper slagging improves the quality of the iron.

The air is introduced into the cupola through the tuyeres. Usually, the introduced air is at room temperature, but preheated air (hot blast) is also used. The volume of air introduced is important and governs the melting rate of the cupola. The air is used in the combustion of the coke, which in turn melts the iron. Under ordinary conditions the blast pressure will vary from 8-20 ounces per square inch, depending on the cupola height, number of charges, and character of charged stock. Some of the larger production foundries have increased blast pressures to 30 ounces per square inch, in order to obtain greater capacity from the cupola.

Devices are available which permit control of the weight of air entering the cupola. This method is more accurate from the standpoint of control than is the measurement of the air volume.

The metal mixture entering the cupola is governed by the composition of the metal desired for the finished castings. Pig iron is the base of the charge. Charges are seldom made up entirely of scrap. Since the pig iron is of known

composition, the greater the amount of pig iron and the smaller the amount of purchased scrap, the more uniform is the composition of the resulting castings. For high-grade castings such as automobile cylinders, the percentage of pig iron is about 35-45 per cent of the charge, while for castings such as sash weights practically no pig iron is used.

Electric Furnace Melting.—There has been a steady increase in the utilization of electric furnace melting for cast iron. This is particularly true in the production of special cast irons. The electric furnace lends itself to a high degree of control in respect to composition and temperature. In some cases, large quantities of scrap, such as borings, can be utilized and a good grade of casting produced. The lower cost of scrap metals for the electric furnaces helps to compensate for the excess melting cost as compared to the cupola.

Two types of electric furnace are in general use: (1) three-phase direct arc; (2) single phase indirect arc of the rocking type. Good results are reported from both types of furnaces.

In some cases the electric furnace is used for the entire melting process while in other cases a duplex method is used. In the duplex method all or part of the charge is melted in the cupola and the molten metal is refined and superheated in the electric furnace. Additions of alloys and steel may be made to the metal in the electric furnace. For steady production the duplex method is usually more economical, owing to the low melting cost in the cupola.

Air Furnace Melting.—The air furnace is used to a limited extent in the production of gray iron castings. This is a hearth type of furnace, in which a refractory wall (fire bridge) near one end separates the hearth from the combustion chamber (fireplace), and a refractory wall (flue bridge) separates the hearth from the stack (flue) near the other end; a removable type of roof permits the charging of large pieces of scrap; flames from the burning fuel (coal, fuel oil, or gas) sweep across the hearth and leave through the stack. The air furnace is frequently used for the higher strength cast irons, because it lends itself to accurate control of composition, and higher pouring temperatures are obtained than with the cupola.

Molding.—A mold is a form or cavity in a refractory material, into which molten metal is poured. The shape of the cavity determines the final shape of the poured metal after cooling. Molds are made by using a pattern whose shape is essentially that of the desired casting. A refractory (such as molding sand) is packed around the pattern. The pattern is then withdrawn, leaving its imprint or shape as a cavity in the refractory. Suitable orifices (known as gates) are provided to permit entry of the molten metal into the cavity or shape.

A majority of gray iron castings is made in so-called green sand molds in which the sand is not baked before molding. The usual refractory is molding sand. This often is a natural product characterized by a silica grain base, the grains being coated by clay which occurs in natural molding sand deposits. When slightly moistened such molding sand has considerable coherence, and maintains its shape when pressed or rammed into place. It also is permeable to gases generated when molten metal is poured

into the mold.

The molding operation usually employs a two-part flask, or container for the sand and pattern, because of necessity of removal of the pattern from the sand, to leave the imprint desired.

When the casting to be made is not a solid design (such as a solid cylinder) but contains an opening through it (as a cylindrical bushing) or is a metal shell (such as a valve body), refractory cores corresponding to the inner dimensions

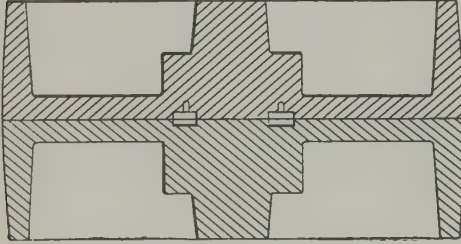


FIG. 2. Pattern for a pulley.

of the casting are placed in the mold cavity. The molten metal flows into the space between the mold cavity and the core, and when solidified has the desired shape and wall thickness.

A simple method of making a mold is shown in Figs. 2, 3, 4, and 5. These diagrams show, in cross section, (1) pattern for a pulley, which pattern, it will be noted, is split into two parts; (2)

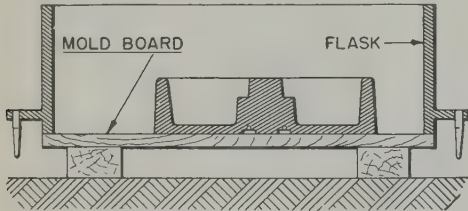


FIG. 3. The drag or lower half of pattern shown in Fig. 2.

(Fig. 3) shows one half of the pattern, the drag or lower half. This is placed on a mold board, on which also rests the flask or container for the refractory molding sand. When the sand is placed therein and rammed about the pattern, the drag (lower half) is rolled over. This will be recognized as the bottom part in (3) (Fig. 4) shown with sand as dotted shading. This illustration shows the cope (or top

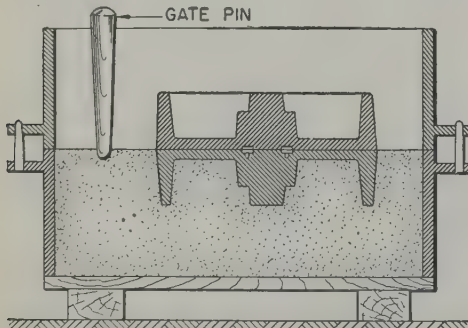


FIG. 4. The drag rolled over, after ramming of sand about the pattern.

half) of the pattern and flask in place, with a gate pin (a portion of the pattern) to make an orifice to receive the molten metal. (4) (Fig. 5) shows the assembled mold, after the pattern has been withdrawn, and a central core placed to make the opening in the hub of the pulley. Molten metal is poured into the opening, upper left, flows downward, then transversely through a "runner" (which has been cut into the drag) and so into the cavity, whose shape is that of the

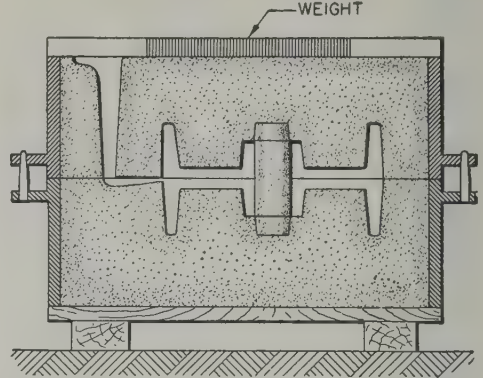


FIG. 5. Assembled mold after pattern is withdrawn and a central core inserted.

pulley to be made. (The white or unshaded areas in Fig. 5 represent the metal sections.)

After the metal has solidified, the mold is "shaken out" and the casting removed. The "runner" is broken or cut off, and the core broken or punched out. The casting is cleaned from adhering molding sand, usually by shot or sand blasting. It then is ready for machining and other finishing operations.

Molding is an ancient art. Only in relatively recent times have scientific approaches and extensive mechanization of the operation been used. Demand for huge numbers of castings of a given design has resulted in development of largely automatic molding operations. Patterns and gating systems often are mounted on plates. The molder places a half flask on the plate. Sand from a hopper fills the flask. Pressure is exerted on the sand by an automatic device (such as a pressure plate) compacting it around the pattern and in the half flask. The pressure plate is lifted automatically. A vibratory or other device slightly loosens the pattern from the sand, then lifts the half flask (with its design imprinted by the pattern). The molder places the half flask on a conveyer. While one molder is making the upper or cope part, another may be making the drag or bottom part of the mold. If a cored job, a core-setter places the cores in position (print pattern extensions, into which projections on the cores are placed, are provided for locating and anchoring the cores). The cope halves are placed on the drag halves. When the mold halves are weighted or clamped (to keep the pressure of the molten metal from lifting the copes) the molds are ready for pouring. Ladles of molten metal are transported from the melting furnaces to the molds, and these last then are "poured off," or filled.

The handling of materials is an involved engineering problem in modern production foundries. Machinery has to a great degree supplanted

the shovel and wheelbarrow, and the hand carried ladles of molten metal.

The molten metal flows from the spout of the cupola into a ladle, which is picked up by a crane or by monorail systems and mechanically transported to the pouring floors. The molds to be filled are on a conveyer line. When metal poured into them has solidified, the conveyer takes molds (and castings) to a "shakeout" station, where sand and cores are separated from the castings. The sand is largely recoverable and is carried to mixing machines where it is "tempered" (proper moisture content restored) and rebonding materials incorporated. From thence it goes to hoppers or storage tanks. From these it is delivered again to the molders for re-use. All these operations are under technical control. Magnetic separators have taken out any metal particles. Bonding materials (such as clays, bentonite, etc.) and moisture have been added on the basis of laboratory tests which ascertain the amounts needed; mixing machines and screens break up all sand lumps, aerate and cool the sand, and place it in best physical condition for re-use.

The castings and attached gating systems are separated mechanically or manually. The gating systems (called returns) are conveyed back to the furnaces for remelting. The castings are cleaned, usually by mechanical means, such as "blasting." In blasting, a high-pressure stream of hard metal shot or coarse silica sand, or even water, quickly cleans the castings of adhering molding sand, so that they can be more readily machined.

The cylinder block of an automobile is a good example of a gray iron casting made by production methods. Such blocks are extensively cored, to provide the water jacket and cylinder bores. Examination of a broken block in a junk dealer's yard and a visit to a local foundry will prove highly informative to the interested reader.

Although the larger percentage of high-production castings are made by green sand molding, substantial tonnages are made by other methods. In dry sand molding, the refractory (natural or synthetic sand with supplementary binders) is rammed (packed into the mold around the pattern) while moist. After the withdrawal of the pattern, the flask halves are dried in an oven. Cores are then placed, flask halves closed, and molds poured. Such molds avoid problems of moisture generated during pouring (as in green sand molding), and they are stronger and better able to withstand the erosive effects of flowing molten metal and its pressure effects. As used for fairly large castings, dry sand molds allow casting of more complicated shapes.

Among methods used for producing very large castings, pit molding is typical. Instead of using a drag (bottom part of a flask), an excavation (or "pit") is made in the foundry floor. The pattern is placed therein and sand with special binder suitably packed around it. A cope flask is rammed and the pattern or pattern parts are removed from cope and drag. Such molds usually have a bonding material (such as a molasses, dextrin, or starch compound) sprayed or swabbed on the surfaces. The mold surface is skin dried by means of a torch or other heating device. Cores are placed and the mold closed (cope placed on drag).

Since pit molding is not a highly repetitive

operation, a high degree of craftsmanship is required. Loam molding also is a specialized art. Loam molds may be used for large concentric castings such as large kettles, cylinders, ring gears, etc. Instead of using full patterns, the general contours are made by use of sweeps (templates or boards having a beveled edge), and some sections made by use of skeleton and part patterns. The backing is made of brickwork, faced with a special loam sand. Faces of loam molds (and cores) are skin dried.

A considerable tonnage of cast iron pipe is made by centrifugal casting or "spinning." A cylindrical metal mold mounted nearly horizontally and faced with suitable refractory is employed. No cores are used. Metal is run into the mold, and the mold rotated rapidly. This throws and holds the molten metal against the inner surface of the mold, until solidified. The shell thickness of the pipe is controlled by the amount of metal run into the mold.

In die casting, molten metal is forced under pressure into a metal die (mold) and pressure is maintained until the metal has solidified. This method is more often used with low melting temperature nonferrous alloys than with gray iron. However, some small, intricate and highly repetitive designs have been made in gray iron. A major problem is obtaining a refractory which protects the metal die (permanent mold) from the deleterious effects of the molten metal.

The ancient "lost wax" process (as described in the *Autobiography of Benvenuto Cellini*) has been revived in what is called precision casting. The method is similar to that used by dentists in making the gold portions of a bridge. This process is rarely used for gray iron.

About 1920 molding was a highly empirical art, demanding great skill and ingenuity. Science and engineering have substituted controlled methods for much of the skill, and mechanical devices for much of the old strong-back labor.

Gray iron is a very satisfactory alloy to cast. It possesses excellent fluidity, so that intricate designs can be run. Its shrinkage (liquid) and contraction (solid) are lower than most metals. Thus it is relatively easy to get sound castings to quite close dimensions.

Metallurgical studies of solidification characteristics and control through directional solidification have promoted more logical designs and indicated the most effective ways to feed for shrinkage (that is to provide reservoirs, called risers, of molten metal which can flow into the casting during its solidification and natural contraction period and thus compensate for the contraction, which last might otherwise leave voids or "shrinkage cavities").

The most widely used refractory for molding is natural molding sand. Such natural product varies considerably. In the old days "feel" and experience were the only guides—sometimes sorry ones. Today foundries test their sands for bond (strength), permeability (ability to allow gases to escape), moisture, and grain fineness. Standards are set and technical control exercised. The desired properties are attained by the use of synthetic additions and by blending. Other refractories than molding sands have been used, for example cement. Oils (used in cores) and other binders and surface coating agencies have been studied, and means devised for testing and controlling, by laboratory methods, many of the procedures that formerly were

largely empirical. Numerous and effective as these advances have been, the foundryman and metallurgist are constantly engaged in seeking further improvements in both quality and economy.

Design and Section Size.—From the viewpoint of producing internally sound castings and relatively complicated shapes, gray iron is an excellent casting alloy. These good casting characteristics are due to its relatively low shrinkage and contraction, and to its high fluidity. However, it is highly desirable that sections of the casting are so proportioned that the sections most distant from the point or points where the casting is to be fed will solidify first, with solidification progressing toward the heads or risers, where the hottest fluid metal is located. "Progressive solidification" is highly helpful in the production of sound castings, and for this reason the design should, insofar as is possible, approach uniformity in section size. Then the

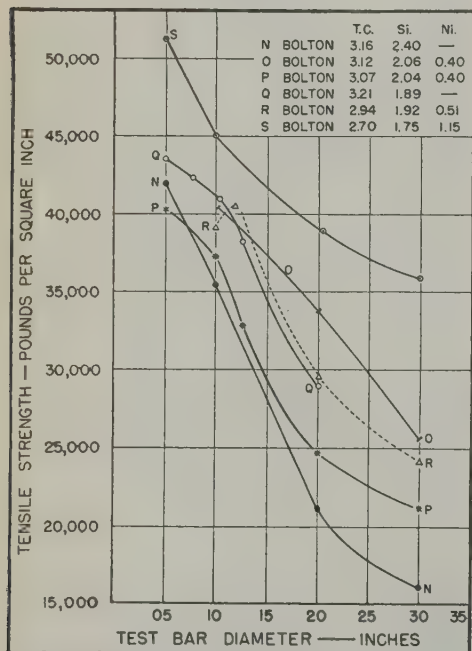


FIG. 6. Showing the relationship between tensile strength and diameter of gray iron test bar.

pouring temperatures and speeds, the arrangement of gates and risers and other controllable factors can be employed to best advantage. While designs are not limited to simple and uniform sections, the artifices that must be employed to achieve success with poor designs, from a foundry viewpoint, always add to the cost of production. In a given foundry, all types of castings made do not possess the same section size, the weights of different designs vary, and it is at times necessary to provide different section sizes in the same casting design.

In a given gray iron composition, the strength varies according to the section size into which it is cast. Gray irons are more sensitive than most alloys to differences in cooling rates, and sections of heavy castings cool more slowly than lighter ones.

Fig. 6 illustrates this effect, as determined from tests on test bars of various sizes. In all cases strength drops as bar size increases. However, the amount and degree of loss in strength is much less in the case of low carbon, alloyed, high-strength iron (top curve) than it is for the somewhat higher carbon, higher silicon metal (bottom curve). The metallurgist and designer must select suitable material not only by strength prescription, but also by the strength desired or needed in a given section. Referring again to Fig. 6, if 35,000 pounds per square inch is required, iron represented by the bottom curve is suitable only for sections represented by a test bar which is one inch in diameter. For sections that cool as slowly as the 3-inch test bar, iron possessing the characteristics shown by the top curve must be employed.

PRINCIPLES OF CONTROL OF PROPERTIES

In the case of pure metals, such as copper, lead, and silver, there is but one structural component—the crystals or grains of the pure metal. Often the possibilities of modifying mechanical properties, such as strength and hardness, are relatively limited. In cast form, some variations in grain size can be effected by differences in cooling rate, as by casting in sand (slower cooling) or into metal molds (faster cooling). Working (and especially cold working) may be used to achieve internally stressed conditions which can considerably augment strength and hardness. However, few casting designs are adaptable to further forming by deformation or working.

Many alloys have two or more structural components. Alterations in the amounts and distribution of the components can be employed to effect marked changes in mechanical properties. Such alterations can be made by variations in composition, by heat treatments, and by other means.

Gray iron is essentially an alloy of iron and carbon. The other elements present are useful in that they affect the iron and carbon structural components.

The matrix, or base metal structure of gray iron, somewhat resembles that of steel. However,



FIG. 7. Coarse graphite flakes in "open" gray iron.

gray iron contains graphite flakes. These flakes are without strength and break up the continuity of the matrix. It is the presence of graphite flakes that makes gray iron an alloy of low ductility. They also impart the characteristic dark gray fracture color, add greatly to machinability (as compared to steel) and (because they expand when the metal is at high temperature and rather plastic) lessen the contraction characteristics and enable sharper mold impressions when formed.



Fig. 8. Fine graphite flakes in close-grained gray iron.

A piece of gray iron, polished and examined under the microscope, appears as shown in Figs. 7 and 8. Fig. 7 shows coarse flakes, characteristic of weak and so-called open-grain iron; Fig. 8 shows smaller and evenly distributed flakes, characteristic of strong and close-grained iron.

To a great degree the foundry metallurgist controls the properties of the iron by controlling the amount, size, and distribution of these flakes. Moreover, he takes into consideration the matrix, particularly with respect to combined carbon (found in the lamellar structure known as pearlite) and a phosphorus-rich component known as steadite (in gray iron, largely a binary eutectic of iron and phosphorus). Factors influencing the properties of gray iron are (1) chemical composition; (2) structural and mechanical make-up of the melting charge; (3) melting process; (4) thermal and mechanical history—furnace spout to cooled casting; (5) subsequent heat treatment; and (6) design and workmanship. With factors 2, 3, 4, 5, and 6 constant, the properties depend on composition, but various foundries employing different methods may produce considerably different results with the same composition or, conversely, the same result with diverse compositions.

Chemical control is exercised largely through the elements carbon (total) and silicon and, to lesser degree, through manganese, phosphorus, and sulphur. Alloying elements such as nickel, copper, molybdenum, and chromium may be employed to modify or augment the results attainable by the preceding elements. Special modifying agencies known as inoculants may be employed in small percentages. Among these are silicides (such as calcium silicide), graphitic carbon, and various complex additions containing one or more of the following elements: vanadium, titanium, nickel, chromium, aluminum.

The furnace charge contains various percentages of pig iron, gray iron returns (gates and risers), scrap castings, and usually some steel scrap. These influence the metal not only according to their composition, but also according to their size and shape. Light pieces behave differently from heavy ones during the melting, probably because of the differences in areas exposed to combustion gases.

The operation of the cupola with respect to the amounts of coke (and its character), the weight of iron charged, the amount of air used, slagging practices, and other factors distinctly influence the mechanical characteristics of irons of given chemical composition. Likewise, iron melted in the electric furnace differs from iron of like composition made in the cupola.

Temperatures attained during melting have a marked influence on the properties of the metal,

as does the temperature at which the metal enters the mold. Gray iron is materially influenced by the rate at which it is cooled from the molten state to temperatures somewhat below the eutectoid (about 1100°F.). The size of section, the thermal conductivity of the mold, and other factors alter the microstructure and the mechanical properties of the metal.

Influence of Carbon.—An increase in total carbon content (other factors being equal) increases the graphitic carbon content, with a consequent decrease in strength, a slight decrease in indentation hardness, and an appreciable improvement in machinability. Over the usual commercial total carbon range, an increase also promotes greater fluidity and a decrease in shrinkage and contraction characteristics. The modern trend is toward lower carbon and higher silicon irons. Some of the disadvantages of lower carbon are offset by the action of silicon, and a better engineering product is attained.

Influence of Silicon.—Silicon is a graphitizing element useful in controlling the relative properties of combined and graphitic carbon. Irons with a very low silicon content do not graphitize as cast. All the carbon then occurs as an extremely hard brittle component—iron carbide, called cementite or chill. Such metal is known as white iron. It is practically unmachinable and has few direct uses.

In the production of gray iron sufficient silicon is incorporated to avoid formation of white or mottled (partially white) iron. If low strength (maximum graphite) is desired, a high silicon content with fairly high carbon is employed. If, in an attempt to get maximum strength, the silicon is decreased too much, white or chilled spots and unsatisfactory machining and engineering properties are incurred.

Besides decreasing the stability of iron carbide (and thus acting as a graphitizer), silicon lowers the percentage of carbon required for the eutectic. This effect modifies the graphite distribution in irons of like carbon but dissimilar silicon content. It is easier in cupola melting to keep the total carbon content lower in the presence of high silicon.

In commercial gray irons the silicon content rarely is allowed to exceed 3.0 per cent. Probably 90 per cent of the tonnage of gray iron castings has silicon contents within the range of 1.75 to 2.75 per cent. Certain special cast metals used for their high resistance to acid corrosion have silicon contents of about 13 to 17 per cent and carbon under 1.0 per cent. These alloys are not gray iron, for graphite is absent. They are somewhat difficult to machine and have relatively low shock resistance. Some alloys with lower silicon content (7 or 8 per cent) that contain nickel and chromium are used for heat-resisting parts, such as grates.

Influence of Manganese.—The manganese content of most commercial gray irons is within the range of 0.40 to 0.90 per cent. Manganese combines readily with sulphur in gray irons, forming a relatively harmless inclusion, manganese sulphide. Changes in manganese content within this percentage range do not have very marked effects.

Influence of Sulphur.—In the presence of sufficient manganese (0.40 to 0.90 per cent), sulphur up to 0.10 per cent, or perhaps more, is without appreciable deleterious effect on gray iron.

Influence of Phosphorus.—Phosphorus contents of most commercial gray irons are within the range of 0.15 to 0.90 per cent. Phosphorus is found in a separate structural component known as *steadite*. One part of phosphorus plus nine parts iron form about ten parts *steadite* by volume. *Steadite* itself is rather hard and brittle. Its melting point is low, about 1800° F. Up to perhaps 0.30 or 0.40 per cent phosphorus, this element is without very marked effect on gray iron. At over about 0.50 per cent phosphorus content there is enough *steadite* so that this component forms nearly continuous grain boundaries, producing a cellular or network structure in the matrix. This net work (other factors being equal) lowers the deflection (ability to bend without fracture) and impact characteristics of the iron. It affects the strength but little. Higher phosphorus also promotes fluidity. However, this effect sometimes is accompanied by a greater tendency toward shrinkage effects, hence greater attention to design and gating is needed. Under some conditions machinability is somewhat impaired. Conversely, abrasive wear resistance may be somewhat improved.

Influence of Alloys.—Since 1925 usage of so-called "alloys" or alloying elements in gray iron has grown rather rapidly. Among the more commonly used are nickel, copper, chromium, and molybdenum. In commercial gray irons these elements are useful both in helping in the control of graphitization characteristics and in strengthening or otherwise modifying the matrix structure. In high percentages (18 per cent or higher "alloy" content) new types of cast irons, the austenitic cast irons, have become available. These are relatively nonmagnetic and have a useful range of resistance to various acid and caustic corrosives.

It was estimated that in 1945 between 10 and 20 per cent of gray irons contained appreciable percentages of added alloys. In 1930 it was estimated that only about 2 per cent had such additions.

Alloying elements may be classified in two general groups—those which promote graphitization and those which restrain it by lessening the tendency of iron carbide to graphitize. The former group lessens tendency toward formation of "chill," the latter to promote the formation of chill or tendency toward hard white iron.

The metallurgist commences his control of the mechanical properties of gray iron by first regulating the total carbon content by raw materials mixture, melting process, etc. The other elements (normal and alloying) are used to control the amounts of graphitic and combined carbon, their distribution, etc.

Silicon is a powerful graphitizer. If sufficient amounts are used to ensure freedom from chill in light, rapidly cooled sections, excessive graphitization and coarse grain are likely in heavy and more slowly cooled sections of the same casting. Such nonuniformity in structure is accompanied by undesirable nonuniformity in mechanical properties. If the silicon content should be reduced to a point where proper structure is attained in the heavy sections, the lighter sections may be found chilled, hard, unmachinable, and brittle. By use of supplementary alloying elements of mildly graphitizing type such as nickel or copper, and by restriction of silicon to amounts suitable for the heavier sections, chill is avoided in the light sections. The net result is

greater structural and mechanical uniformity throughout all sections. It is fortunate that these mild graphitizers (such as nickel and copper) have relatively much less graphitizing effect in heavy sections. Furthermore, they tend to harden and strengthen the matrix in these heavy sections.

Chromium is a powerful carbide-stabilizing element. When heavy sectioned castings and light sectioned ones are to be poured from the same molten iron mixture, the silicon content is made suitable for the light sectioned castings, Metal going to the heavier ones has some chromium added. This offsets the action of silicon, which otherwise would be excessive for the purpose. In many cases it is found desirable to use complex alloy additions, for example nickel-chromium, copper-chromium, nickel-chromium-molybdenum and others, so balanced as to attain combinations of structure and properties less easily attainable by simple procedures.

Molybdenum is a mild carbide stabilizer. Suitable additions afford one of the simpler methods of increasing strength without the marked danger of encountering chill, incurred by use of more powerful carbide stabilizers. Molybdenum tends toward the production of a finer grained, stronger matrix structure. When it is used, a slight upward revision of silicon content, or the addition of a mild graphitizer (such as nickel or copper) is the usual practice.

The best foundry practice includes suitable manipulation of carbon and silicon practice first, to get the best combination of these for the purpose involved. Alloys and alloying elements are used to supplement only when necessary. Reduction of total carbon content is in itself very potent toward promoting uniformity of strength, particularly throughout medium and heavy sections. If the iron is properly processed and the normal elements are in correct balance, alloys and alloying elements, if necessary, can then be used most effectively and economically.

Controls Other Than Composition.—*Inoculation.*—It has been discovered that various substances and admixtures added to the molten iron shortly before pouring may considerably modify its structural and mechanical properties. Such substances are called "inoculants." Calcium silicide was probably the first used inoculant. Other silicon-containing substances, such as nickel-silicon and ferrosilicon, are used. Various complex alloys which may contain vanadium, nickel, chromium, copper, titanium, aluminum, molybdenum, etc., in various proportions, and even graphitic carbon have been employed. Inoculants are added in quite small amounts. Their action is different and in some respects more potent than that of additions of alloys and alloying elements previously discussed. Inoculants can and are being used in numerous cases to lessen tendency toward chill, or hard spots. In this respect they act as graphitizers. Under some conditions (especially on external surfaces) some gray irons may tend toward production of extremely fine graphite flakes in a soft or ferritic matrix. In such cases inoculants often have been found useful to produce a normal-sized graphitic structure and a desirable pearlitic matrix. (These effects are not necessarily paradoxical.) If molten inoculated iron is allowed to stand for a long period, the effects of the inoculant gradually disappear. It is thought that inoculants act as nuclei for the

formation of graphite flakes.

Superheating.—High melting temperature has marked effects on the properties of gray iron. In the case of irons of fairly high carbon content, high melting temperatures (usually in the range 2850° F. to 3000° F.) tend to retard slightly normal graphitization tendencies and to bring about finer grain and increased strength. Section sensitivity is decreased. Ordinary cupola melting temperatures are lower than the superheating range. Therefore, when superheat is desired electric furnaces are often used. Since the costs of electric melting are high, the usual practice is to melt the iron in the cupola, and transfer the molten metal to an electric furnace for superheating.

Heat Treatment.—Heat treatments of gray iron are undertaken for one of two purposes: (1) alteration of structure and mechanical properties, or (2) relief of internal stresses as set up in the casting process.

If a gray iron is heated above the eutectoid transformation range (for example to about 1550° F.), the ferrite (alpha iron) changes to gamma iron. The gamma iron is capable of dissolving the combined carbon of the pearlite, forming a solid solution known as austenite. If the metal is quenched (cooled rapidly), the austenite has not time enough to revert to the normal or pearlitic condition when passing through and below the eutectoid transformation range. A transition product, usually martensite, is formed. Martensite is hard and brittle. Its formation results in lowered strength. If, however, the metal is tempered or drawn (heated back to a moderately elevated temperature, say 750° F.), the brittle martensite is decomposed, and intermediate structural products are formed. The net result is an increase in strength and hardness. In irons of suitable composition the tensile strength increase may be about 40 per cent above the original value.

Oil is a commonly used quenching medium. The use of alloys and fairly low total carbon contents are desirable in irons to be heat treated. Because it is nonductile, quenching of gray iron is best confined to simple shapes.

Conversely, for machining purposes, it may be desirable to soften the iron. This is accomplished by annealing. The castings are heated to the temperature range 1500° to 1600° F., and cooled slowly therefrom. Under properly controlled conditions all the combined carbon is converted to graphite. The metal structure then consists wholly of a ferrite matrix and graphite flakes. It is soft (usually around 120-130 Brinell hardness number) and highly machinable. Annealing treatments result in loss of strength, a reduction of about 20 per cent from the original cast strength being usual.

Relief from internal stresses may be accomplished by heating for suitable periods to about 900° F. or slightly above. As a casting cools it contracts, and since cooling rates are not uniform, due to variations in section size, certain portions will contract more rapidly than others. Expansion and contraction effects are also set up by structural changes in the transformation range. These effects set up internal stresses which may seriously weaken castings of complicated design. Although reheating (stress-relief) at about 900° F. does not produce structural changes, the metal does become more plastic, and thus the internal stresses are eliminated

by plastic flow.

Various other heat treatments are used occasionally on gray irons. Among these are flame hardening (surface quenching), isothermal quenching, induction hardening, and nitriding (a case treatment). The principles involved are essentially similar to those employed for steels

PHYSICAL PROPERTIES

The attributes or characteristics which a substance possesses are termed its physical properties.

Density.—The specific gravity of gray irons varies from about 6.95 for weak, coarse grained irons to about 7.35 for irons in the 30,000-40,000 pounds per square inch strength classes. Some of the high strength, low carbon alloyed irons have densities of about 7.5. That of white cast iron is about 7.7. (The specific gravity of cast steel is somewhat higher, about 7.80.)

A specific gravity of 7.7 is about 487 pounds per cubic foot, or 0.29 pound per cubic inch. A specific gravity of 7.0 is about 437 pounds per cubic foot or 0.26 pound per cubic inch.

Gray iron is thus appreciably lighter (per unit volume) than steel. The major reason is the presence of graphite flakes (specific gravity about 2.25) in gray iron.

Melting and Freezing Temperature Ranges.—Unlike pure metals, gray iron does not melt, or freeze, at some single temperature. Each of the structural components: eutectic, primary austenite, and steadite (phosphorus rich component) melts, or conversely, freezes, at a different temperature or temperature range.

The initial freezing point (above which the metal is completely liquid) may be as high as about 2450° F. for low carbon iron. As the carbon (and silicon) content is increased, the initial point (liquidus) becomes lower, reaching, in irons of eutectic composition, about 2100° F.

The final solidification or solidus temperature (or, conversely, the point above which all low phosphorus cast irons start to become liquid) is just above 2100° F.

The phosphorus-rich component steadite remains fluid until a temperature of below 1800° F. is reached.

Specific Heat.—Specific heat is the heat (expressed in Btu. or in calories) required to raise the temperature of a unit mass one degree (° F. in case of Btu., ° C. in case of calories). The specific heat of a high carbon iron at different temperatures is shown in Fig. 9. The specific

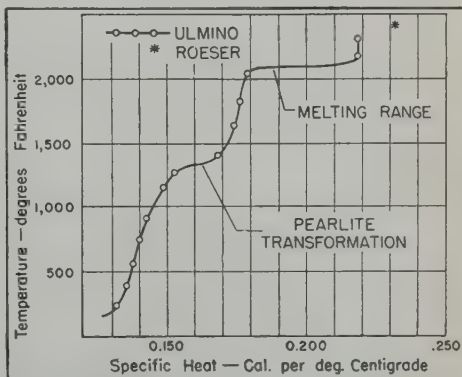


FIG. 9. Showing the variation of the specific heat of a high carbon iron with the temperature.

heat increases with increase in temperature. There is an abrupt increase when entering the pearlitic transformation range, where alpha iron (ferrite) changes to gamma iron (austenite). There is a large increase where the metal changes from solid to liquid. The heat of fusion is about 47 calories per gram.

Contraction.—The qualitative relationships of temperature and of contraction characteristics are shown in Fig. 10.

Coefficient of volume shrinkage in liquid state is about 0.006 per cent per degree Fahrenheit (0.011 per degree Centigrade). The volume change during solidification may be as low as 1.6 per cent for a high carbon, high silicon gray iron composition to as high as 5.8 per cent in a low carbon, low silicon white iron composition. The lower carbon gray irons, showing relatively high contraction, liquid to solid, must be well fed with fluid metal if "shrinkage cavity" defects are to be avoided.

The solid contraction of gray iron is lower when graphite content is high, that is, high car-

bon, high silicon irons show lower solid contraction. The solid contraction of a heavy section usually is less than that of a lighter section of similar composition.

Surface Tension.—Surface tension (dynes per square centimeter) in an iron 3.22 per cent carbon, 2.76 per cent silicon and 0.49 per cent phosphorus was found to be 936 at 2313° F., and 914 at 2404° F. (This compares with 1,018 for gold at 2050° F. and 1,178 for copper at 2100° F.).

Thermal Conductivity.—The usual range of thermal conductivity of gray iron extends from 0.100 to 0.140 calorie per square centimeter per second per centimeter per °C.

Thermal conductivity decreases with an increase in temperature and with an increase in flake graphite (accompanied by an increase in total carbon). However, a reduction in combined carbon in a given iron (as by annealing) is effective in increasing thermal conductivity despite an increase in graphite content. (The conductivity of iron carbide is quite low.)

The thermal conductivity of gray iron is lower than that of steel, and markedly lower than that of nonferrous alloys. However, its excellent castability in thin sections (which expose large areas to dissipate heat) and low cost make it suitable for applications such as radiators, stoves, cooking ware, glass molds, drying equipment, and brake drums.

Corrosion.—Gray iron is more resistant than carbon and low alloy steels to many types of corrosion. Although in moist atmospheres it forms a rust coating rather readily, continued rust penetration and consequent disintegration usually is quite slow in comparison to steel, perhaps because the underlying graphite flakes form a protective (and adherent) coating.

In water pipe, cast iron has given splendid life. In soil pipe it usually lasts much longer than steel pipe.

Although different classes of gray iron do not vary much in resistance to a given water or soil condition, different waters and different soils vary quite widely in their corrosive effects. For example, some mine waters contain small percentages of sulphuric acid, others contain copper salts. In these and similar cases specially alloyed metals are required to resist the corrosive effects.

As is the case with all common metals, corrosion resistance of gray iron is impaired when stray electric currents are encountered (as in cities). Many crude oils and refinery products are relatively noncorrosive toward gray iron. High sulphur oils containing moisture, and some of the salt crudes are rather corrosive toward gray iron and steel. Gray irons are usefully resistant to most natural and artificial gases.

Although gray iron is resistant to strong sulphuric acid (60° Bé. to 66° Bé.), it is attacked rapidly by more dilute sulphuric acid. Hot fuming sulphuric acid (oleum) attacks and disintegrates gray iron. Gray iron is fairly resistant to cold concentrated phosphoric and nitric acids, but impurities such as hydrofluoric acid and chlorides materially impair its resistance. Dilute phosphoric and nitric acids attack gray iron quite rapidly. It is not resistant to hydrochloric (muriatic) acid in any concentration.

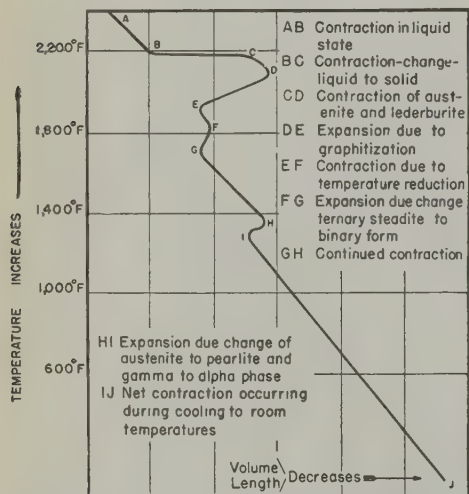


FIG. 10. Showing qualitatively the contraction and expansion of gray iron at various temperatures.

bon, high silicon irons show lower solid contraction. The solid contraction of a heavy section usually is less than that of a lighter section of similar composition.

The patternmaker usually allows about $\frac{1}{8}$ inch per foot oversize in his patterns to offset the contraction characteristics.

From room temperature to about 850° F. the coefficient of expansion for a given gray iron remains approximately constant. Values usually are in range 6.70 to 6.95×10^{-6} per degree Fahrenheit.

Coefficients for the highly alloyed austenitic irons are much higher, usually from 9.5 to 9.9×10^{-6} per degree Fahrenheit.

Above about 850° F. gray irons often "grow" or expand slowly and permanently due to gradual precipitation of more graphite, and to internal corrosion.

Fluidity.—From a practical viewpoint the term "fluidity of gray iron" is used to indicate the relative ability of the metal to fill a mold, that is, it indicates the running and feeding

Gray iron is resistant to many alkaline and caustic solutions, for example: sodium hydroxide, lye, soda ash, ammonia, etc. It is not embrittled by exposure to strong, hot caustics. Where some slight coloration (due to solution of traces of iron) is not objectionable, gray iron has proved very useful in alkaline fluids, as used in manufacture of glass, sodium silicate, soap, viscose rayon, paper, dyestuffs, textiles, treatment of petroleum, etc. In general, fine close grained irons (as in the 30,000-40,000 pounds per square inch tensile classes) are more resistant to corrosives than are the lower strength, more open grained types.

With but few exceptions, the usage of small amounts of alloy elements is of little or no benefit toward enhancement of the corrosion resistance of gray irons.

Increases in temperature of corrosive fluids usually increase their corrosive effects. Gray irons are frequently used at elevated temperatures. At quite high temperatures (850° to 900° F. and over), ordinary gray irons are subject to "growth," a type of internal disintegration produced by extreme graphitization and considerable internal corrosion. Above about 1100° F. gray irons usually scale rather rapidly, particularly where combustion gases contain corrosives such as oxides of sulphur.

Several types of special cast irons have been developed to resist various types of corrosives. Prominent among these are the austenitic gray irons known commercially as "Ni Resist" and "Causal Metal." These are manufactured to several compositions, embraced within the following range: nickel 14 to 30, copper 4 to 7, chromium 0.5 to 3.5, molybdenum to 1.0 per cent. Some of these are quite usefully resistant to sulphuric acid, over the total range, dilute to concentrated. (They are not resistant to hot oleum.) They are resistant to the less severe types of hydrochloric (muriatic) acid conditions and to some phosphoric acids. Nitric acid attacks them severely. They have fair resistance to some organic acids, such as acetic, oleic, stearic, and red oil. Types containing 18 per cent or more nickel (with or without other alloys) are nearly immune to the corrosive effects of alkalies and caustics, weak or strong. They are, however, subject to stress corrosion in strong, hot caustics. If stresses are kept below about 10,000 pounds per square inch, these types can be used safely with boiling concentrated caustics.

While not immune to rust, these irons form rust slowly and do not disintegrate by rusting. They are resistant to scaling at elevated temperatures and are not subject to growth. In many services austenitic irons are economical substitutes for some of the high alloy stainless steels.

High silicon irons (usually about 15 per cent silicon) are resistant toward many acids, exceptions being hydrofluoric acid and hot concentrated hydrochloric (muriatic) acid. They are useful for conditions where free "wet" chlorine is encountered, and are unusual in that they have good resistance to solutions containing copper salts. The high silicon irons have the disadvantage of being hard and brittle. Thus they are costly to manufacture, and their fragility necessitates that they be handled carefully in installation and usage.

The high chromium irons (usually 24 to 35 per cent chromium) are resistant toward many corrosives, including nitric acids (except fum-

ing) and solutions containing free chlorine. They are nearly rust immune and highly resistant to scaling. They are attacked by strong caustics.

Corrosive conditions vary so widely that specific recommendations should be made only after study of the particular case. This discussion should be used only as a general guide.

Electrical Properties.—Resistance of gray iron to passage of electrical current is higher than that of ordinary carbon steel. Gray iron is not a good current conductor. Increase in flake graphitic content may be expected to increase resistivity. Silicon increase has a similar effect, and so does increase of nickel.

Treatments which produce the nodular form graphite (as in malleable cast iron) tend to decrease resistivity. Commercial gray irons usually have specific resistance (microhms—centimeter) within the range 50-110. Gray iron resistance grids find some uses where fairly high current is involved. Its resistance is relatively high and its thermal dissipation characteristics are good.

Magnetic Properties.—Gray iron (ferrite-pearlite matrix) is magnetic. The highly alloyed austenitic cast irons are but slightly magnetic. Increase in magnetic induction and permeability and decrease in coercive force are attained when the metal is low in combined carbon. Such a material also has low hysteresis loss. An increase in the graphitic carbon content in flake form does not affect the hysteresis loss, but inhibits attainment of high magnetic induction. Lack of structural continuity (because of graphite flakes) causes small demagnetizing forces. This limits retentivity and unsuits the metal for usage in semipermanent magnets. Because of its relatively low permeability and inability to carry as high flux densities as rolled steel, gray iron is of limited use for magnetic applications in electrical machinery. It is used for frame members where flux densities are low, and inexpensive yet complicated shapes are needed.

Mechanical Properties.—The physical properties which concern the mechanical utilization of the material are further classified as mechanical properties. Useful mechanical properties of a material depend largely upon its strength, namely ability to resist forces. Strength may be manifested by resistance to flexure (property of rigidity) and to permanent deformation (property of plasticity). The term "strength" also contemplates resistance to local destruction (as by fracture or breakage) and to more general disintegration (as in wear).

In the case of gray iron the potential strength properties are inherent in the matrix, or continuous structure. The matrix contains many weak graphite flakes. The amount, size, shape, and distribution of these may have a greater influence on strength than the matrix structure itself. Thus, to get a high-strength iron, it is necessary to provide a strong matrix and to control the graphite so that the latter is least effective in breaking up matrix continuity.

Mechanical loadings can be grouped as (1) static (slow rate of loading) and (2) dynamic (rapid or nearly instantaneous loading). Gray irons are particularly useful where static loadings are contemplated. Since they do not possess much ductility and are not appreciably plastic, dynamic loads of high intensity may cause rupture. This does not mean that gray iron is a brittle material. It has quite a useful

range of toughness. Furthermore, it is not sensitive to "notch effects," and also possesses marked "damping" capacity. The latter minimizes the danger of load build-up through synchronous effects, which sometimes adversely affect more ductile metals.

When cast iron is stressed, the resultant strain consists of both elastic and plastic deformation. The true tensile properties of gray iron are not shown fully in the ordinary tensile test. The breaking load or ultimate strength is determined, also the relative rigidity. To determine the possible elastic rigidity and the plastic deformation, repeated loading tests must be employed.

Owing to difficulty in establishing the time elastic modulus in routine testing, this characteristic, in gray irons, usually is expressed as relative modulus at 25 per cent of ultimate tensile strength. This is determined by the slope from 0-0 of a line passing through the strain exhibited at 25 per cent of ultimate tensile strength. Relative moduli of elasticity so determined may be as low as 12,000,000 pounds per square inch for weak soft irons to possibly 28,000,000 for the very highest strength irons whose tensile strengths approach 100,000 pounds per square inch.

Deformation in gray irons has been shown to consist of both elastic and plastic components. It is known that ductile materials such as steel, if loaded for long periods, will fail at stresses much below the tensile strength as determined in short time testing. Test specimens "neck down" and lose maximum total load carrying ability. Cast iron in tension does not neck down or deform much in cross section, even at the breaking load. "Creep tests" are used to determine the maximum loads which can be sustained over long periods of time. In such tests the specimens are loaded to predetermined stress intensities and remain so loaded for long periods of time—about 1,000 hours or more. If continued extension of a specimen is observed, the material is said to creep or flow under the load. If no extension is observed, the material is considered to be within its limiting creep strength.

Such tests indicate that (at room temperatures, and probably up to 650° F. or slightly above) the long-time strength of gray iron approaches the test value determined by the ordinary short-time test, and that yield strength and tensile strength are practically the same, once "set" (permanent deformation) is removed.

Tensile strength is important from the standpoint of engineering design and of manufacturing economy, and it is a variable used in most engineering formulas. It thus influences the size of sections necessary for the required design. With stronger iron, lighter sections often can be used. On the other hand, stronger irons usually are somewhat more expensive to machine and also may require more costly foundry procedures. The designer thus must balance the various economic factors of weight and other production expenses.

Modern practice classifies engineering gray irons according to minimum tensile strength. This classification is given in the accompanying table, an excerpt from the American Society for Testing Materials Specification A-48-41.

As shown, classes from 20,000 to 60,000 pounds per square inch are available under that

Class	Tensile Strength Minimum, pounds per square inch
No. 20.....	20,000
No. 25.....	25,000
No. 30.....	30,000
No. 35.....	35,000
No. 40.....	40,000
No. 50.....	50,000
No. 60.....	60,000

specification. The bulk of commercial gray irons is found in the classes from 25,000 to 50,000 pounds per square inch minimum tensile strength. However, irons above 70,000 pounds per square inch minimum tensile strength are obtainable by special processes, compositions, and treatments. Any iron found testing below 20,000 pounds per square inch tensile strength suggests the likelihood of unsoundness, due to bad design, to improper selection of composition, to poor foundry practice, or to a combination of these.

Usage of gray iron in unfired pressure vessels is restricted to a maximum of 450° F. by various codes. Within this limitation there is no perceptible change in strength; in fact, no published tests have indicated any deterioration up to 700° F., and perhaps appreciably higher in the case of the stronger classes of gray iron. For this reason the American Society for Testing Materials provides a specification (A 278) covering classes suitable for usage to 650° F.

Transverse Strength.—The transverse test is widely used for foundry control and specifications. In this test, the test bar is supported on knife edges and broken by a load applied midway between these supports. The distance between supports is the span. Deflection at the center is measured. Usually the ultimate load in pounds and the ultimate deflection in inches are reported. Since the load and deflection depend on the span and size of the section, as well as the material, the sizes of test bars and span are specified.

The deflection at the moment of breaking gives some measure of ductility. As tested on the conventional transverse bar of 1.2 inches diameter over 18 inches span, deflections on various irons may run from 0.15 to 0.35 inch. The higher strength irons usually show somewhat lower deflections than the soft ferritic irons. High phosphorus lowers deflection values. At a given strength level, higher deflection may indicate tougher iron.

Compression Strength.—Cast iron is much stronger in compression than in tension. On a series of tests covering many types of cast iron the compression strength ranged from 65,000 to 160,000 pounds per square inch. The ratio of compression strength to tensile strength varies from about 4.5-1 for the weaker irons to 2.5-1 for the stronger irons.

Shear Strength.—This property is rather closely proportional to tensile strength. The tensile strength (pounds per square inch) plus 9,000 pounds per square inch approximates the shear strength, in pounds per square inch. (This relationship is for regular gray irons. It would not hold for high phosphorus irons, mottled irons, or chilled irons.)

Torsional Strength.—The ratio of torsional strength (modulus of rupture in torsion) to tensile strength usually is within the range 1.2 to 1.4. The torsional strength is higher than the tensile strength, and increases with increase in

tensile strength.

Hardness.—The Brinell hardness test is a useful one for gray iron castings. The Rockwell test is also used, employing the *B* scale and the steel ball. In the "as cast" condition, commercial (nonalloy) gray iron castings will range from 130-210 Brinell hardness. The alloy cast irons will run higher and heat-treated irons may run over 600 Brinell hardness. Ordinary white irons will range from 321-534 Brinell while alloy white irons may run as high as 700.

Although the trend of indentation hardness is to increase with increase in tensile strength, the ratio of hardness to tensile strength is not constant. One property cannot be safely predicted from the other. The relationship of Brinell hardness to compressive strength is fairly constant. Compressive strength often can be approximated by multiplying Brinell hardness number by 750, up to values of about 200 Brinell hardness number.

Brinell number is a general indicator of machinability, but is not an accurate measure of that property.

Wear.—The term *wear* has generic rather than specific significance. Wear signifies a gradual eating away or dissolution of a structure resulting from the action of mechanically applied agents. Often mechanical wear and deterioration by corrosion act concurrently. The wearing agent may be a fluid (gas or liquid) or a solid.

With a perfect lubricant film there can be no wear. Wear occurs when there is no lubricant, or when the lubricant film breaks down, or when the lubricant is imperfect and a carrier of wearing agents (abrasives).

In the case of metal to metal wear (no lubricant), gray cast iron reveals a high degree of usefulness. Its highly heterogeneous structure effectively inhibits seizure and galling. It not only wears well on itself, but also with many other alloys. It has a tendency to cut much softer alloys, but usually works well with alloys as hard or harder than itself. This property of gray iron is among those responsible for its extensive use in machine tools, where heavy pressures and imperfect lubrication occur, and in automobile cylinders, where temperature and partial lubricant breakdown are factors. An example of metal to metal wear is in automobile brake drums. Gray iron, with its graphitic structure, is more free from the tendency toward seizure than the nongraphitic ferrous alloys.

The properties in gray cast iron which are associated with a low rate of wear are pearlitic matrix, suitable hardness, and high strength. Other things being equal, an iron with a pearlitic matrix will resist wear better than one containing free ferrite.

Heat treatment or special alloy additions which produce martensite and other hard matrices improve wear resistance. Usually some increase in resistance to metal to metal wear may be expected from such increased hardness. The major gain, however, is from increased resistance to abrasive action (sand or grit). Localized heat treatment (flame hardening) has often proved useful.

White cast irons are relatively resistant to abrasion. Some of the alloyed hard white irons not only are resistant to abrasive influences, but also have good resistance to galling and seizure.

Because there are many types of wear, it is

practically impossible to set up any laboratory test which will give an adequate measure of the wear resistance of a material in service. However, laboratory tests have been of value in helping to develop better materials for resisting wear. Some of the conclusions from laboratory tests are as follows: (1) wear resistance increases with matrix hardness; (2) with increasing combined carbon content, the resistance to wear of gray irons increases rapidly up to 0.60 per cent combined carbon and then slightly up to 0.85 per cent; (3) increasing silicon content decreases resistance to wear.

Machinability.—Machinability ranges of cast irons are wide. Cast irons may be made to suit many conditions, remembering that ease in machining is usually inversely proportional to the strength of the casting. Machinability of metals has been variously determined with reference to: (1) tool life, (2) type of finish obtained, (3) power required.

The composition, structure, and physical properties of cast iron extend over a wide range. Dependent upon these factors, cast iron varies from one of the most readily machinable to the most unmachinable of ferrous materials. At one extreme of this range we have completely annealed permanent mold cast iron, which is the most readily machinable; at the other extreme is white or chilled cast iron and iron hardened by heat treatment. Annealed permanent mold cast iron possesses excellent machinability because the structure consists of iron containing no combined carbon and broken up by a high percentage of finely divided free carbon flakes, together with freedom from burned-in sand at the surface. Chilled or white iron is extremely difficult to machine because its structure is composed chiefly of hard iron carbide in both pearlitic and massive form, unbroken by any flakes of free carbon.

When nickel with low silicon and chromium content is used, it permits machining irons of considerably higher hardness than could be machined without the use of nickel. The reason for the ability to machine irons of 225-250 Brinell in alloy compositions is that no massive carbides exist in the matrix. As soon as plain cast iron exceeds a hardness of about 220 Brinell, it usually contains hard carbides, especially at the edges and corners of light castings.

Chromium is a carbide former, and if as much as 0.25 per cent is added to plain cast iron which is already at the limit of machinability, the iron may become difficult to machine. Care should therefore be taken in adding chromium, where machinability is a factor. However, on many soft irons, as much as 0.50 per cent chromium may be added with little effect on machinability.

The high chromium irons (35 per cent chromium), although white irons, structurally are softer and more readily machinable than other white irons.

The austenitic gray irons have approximately the same machinability as regular gray irons of equivalent tensile strength. However, the austenitic irons are subject to surface work hardening when surface distortion without proper metal removal is incurred. Improperly sharpened tools and rubbing action by tools or by chips should be avoided.

The high silicon (15 per cent) cast irons are quite difficult to machine, and grinding is usually employed. The newer carbide tools have

possibilities.

Molybdenum is frequently used as an alloy addition in cast iron to obtain increased strength and wear resistance. Where molybdenum is used to increase hardness and strength without the formation of carbides, machinability will usually be inversely proportional to the hardness and strength produced.

The surface condition of iron castings is most important in determining machinability. Frequently castings are condemned as unmachinable when the metal itself is quite machinable, but difficulty is caused by the presence of burned-in sand on the casting. Where burned-in sand is present, any attempt to make light surface cuts will cause rapid failure of the tool. A sufficient depth of cut must be made to ensure the point of the tool being well below the surface of the casting.

The character of the surface finish obtainable in machining cast iron is dependent upon the size of the graphite flakes and the total amount of the graphite. A high total carbon, high silicon cast iron with large graphite flakes will show a pitted surface when machined due to tearing out of particles of metal between the graphite flakes. Rough cuts taken on coarse grained cast iron will exaggerate the pitted appearance by tearing out small particles of iron. The lower carbon irons will give a much better appearance when machined.

Newer types of tool materials, such as the tungsten carbides and newer machine tool designs permit rates of metal removal in some operations which were not attainable with older tool materials and with older type machine tools. The newer carbide tools are more resistant to the abrasive action of small carbide particles, to the hard phosphorus-rich component steadite, and to burned-in sand. Usually the resistance of cast irons does not produce high tool pressures. It is not prone to seize and crater on tool faces. In many cases newer tools and newer machines permit faster machining of many types of cast iron.

Dynamic Strength.—Metals are often used under rapidly repeated or alternated loadings. To the layman such loadings often are referred to as vibratory stresses. The engineer calls ultimate resistance to such stresses fatigue strength or endurance limit. As with other metals the endurance limit of gray cast iron is less than its ultimate tensile strength.

Deterioration in fatigue is progressive in nature, much more gradual than failure in tension of a ductile material. Under a sufficiently large number of restressings, incipient fractures are started in small flaws, since the latter promote increased localized stress intensity (the start of cracks) and the gradual progress of fracture from these points. In ductile materials, fracture in tension tests is preceded by perceptible elongation and reduction of cross sectional area. In these same materials fatigue may be sudden, as the repetitions of stress result in sudden brittle-acting failure, with no stretch or elongation to give warning of impending fracture, with the exception of possible visible cracks.

It is said (incorrectly) that the steel has crystallized, because of this brittle fracture. It was always crystalline, and the alternating stresses, not the crystallinity of the material, caused the characteristic fracture.

The endurance limit of gray iron in com-

pletely reversed cycles of bending stress varies from about 40 to 55 per cent of its tensile strength. (This is also about the same proportional relationship found in case of steels.) Thus a stronger gray iron can be expected to have a higher endurance limit than a weaker iron. This is also true of alternating torsion stresses and of alternate tension-compression stresses.

Some ductile metals, for example some types of steel, are very sensitive to notches and other surface discontinuities. When these exist, the material may fail in fatigue (endurance) at quite low stresses. Fortunately many gray irons, especially the lower strength classes are much less affected by notches and other surface discontinuities.

As is the case with most metals, corrosive effects may lower the endurance limits of gray irons.

The effects of elevated temperature are quite similar on both tensile strength and endurance limits. Up to about 800° F. these properties are changed little from their room temperature values.

Damping: Gray iron is effective in damping or absorbing vibratory impulses. This property (damping) is measured by the length of time it takes for a vibrational impulse to die out. A hard steel tuning fork has low damping capacity. If struck it will continue to vibrate audibly for some seconds, and inaudibly for some longer time. If the fork were made of lead, it would sound dead when struck. Lead has very high damping capacity. Gray iron is intermediate in this characteristic. Imposed oscillations are more rapidly dampened in cast iron than in steel.

Damping capacity is a significant factor in choice of materials for machines which encounter vibrational impulses during operation. If such impulses synchronize, the amplitude of vibration may become very great, and result in failure or breakage. In all cases vibrations mean loss of useful power, and interfere with accuracy in alignments. Designers have learned to take good advantage of gray iron's relatively good damping capacity.

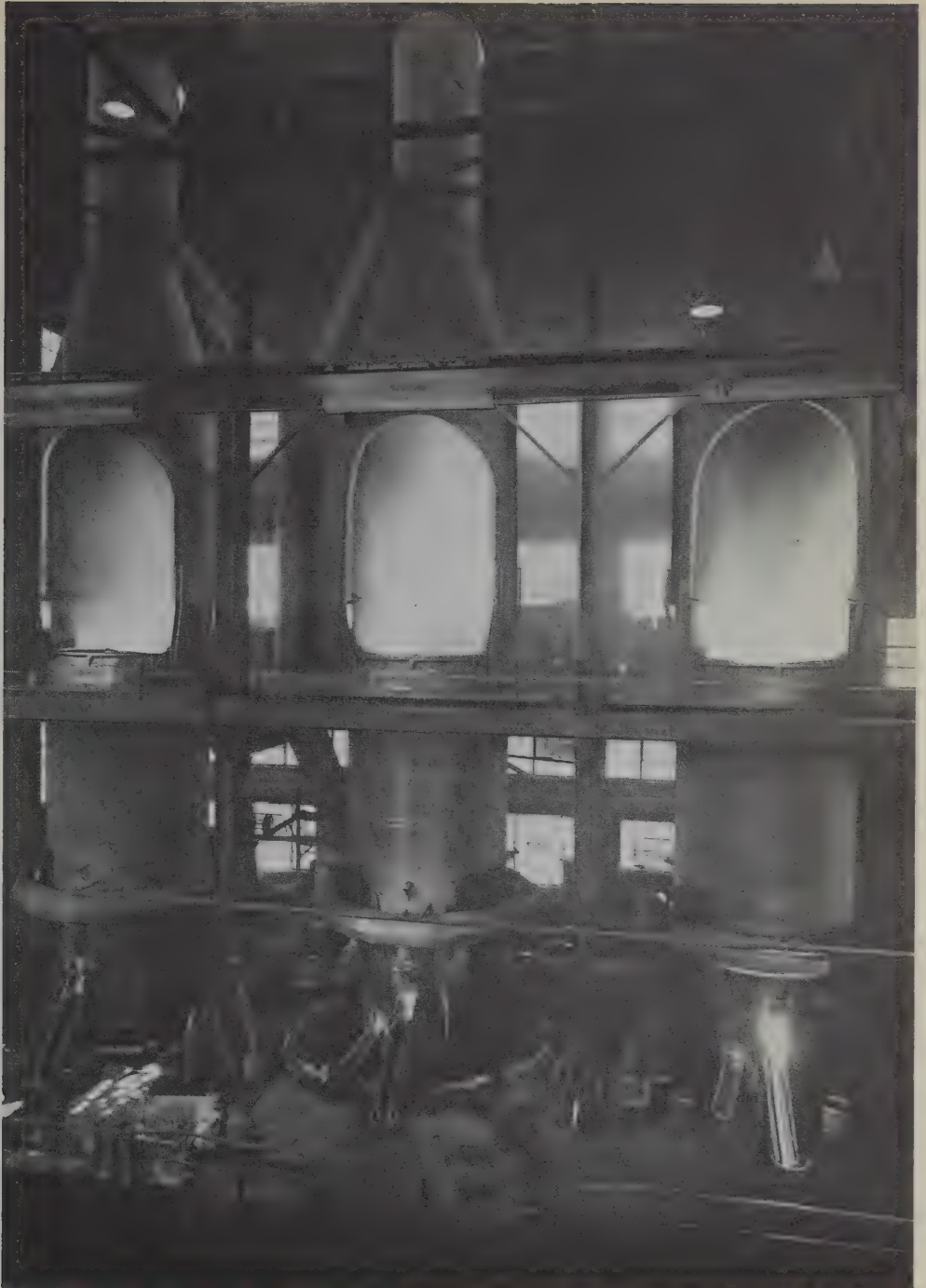
Impact: Gray iron is not employed where high resistance to impact or shock is a requirement. It does, however, possess a surprisingly wide range of usefulness where mild shock resistance is required. Automotive pistons are a familiar example. Lately, even in large Diesel engines, gray iron crankshafts have proved quite adequate.

There is no exact relationship between shock resistance and tensile strength. Stronger irons, particularly the lower carbon varieties, usually are the more shock resistant. Of two irons alike in strength, the one with more ductility, or with greater deflection in the transverse test may be expected to have the greater shock or impact resistance. High phosphorus content tends to lower shock resistance.

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4. PIG IRON.—Pig iron is the crude, commercial, metallic product of an iron blast furnace, and is the basis of the whole iron and steel industry. Practically all forms of iron and steel products in existence originally came from pig iron, which in turn was smelted from natural iron ores or from iron-bearing byproducts; meteoric iron (usually museum exhibits) and "direct reduction" iron, often in the form of

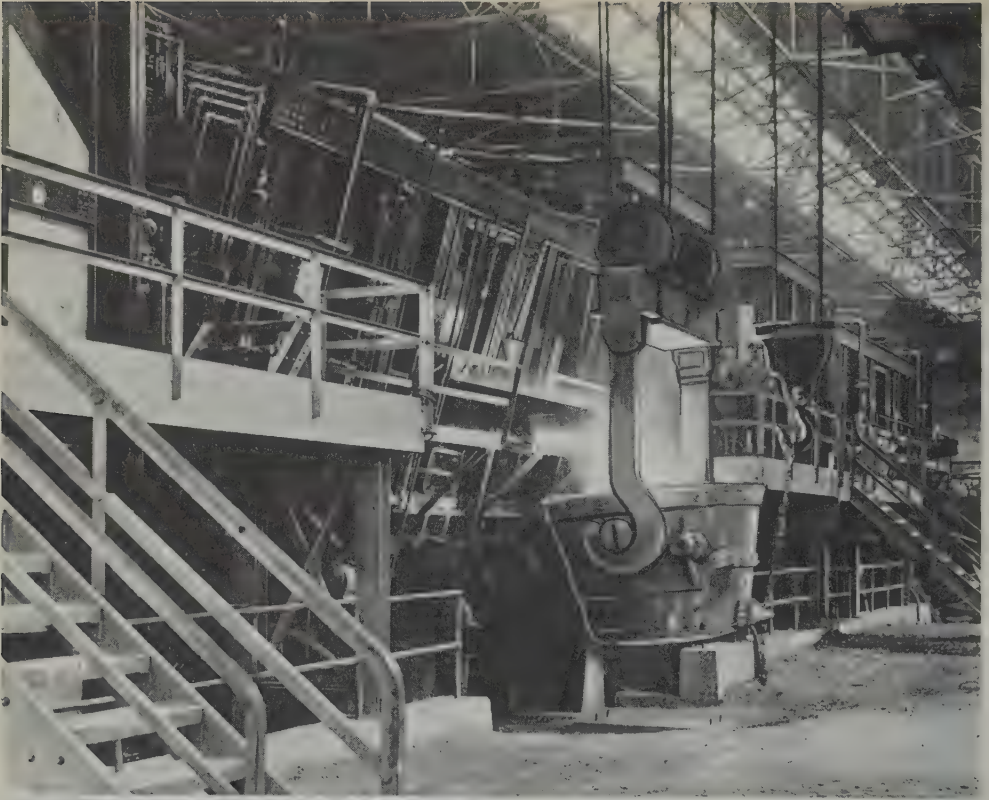
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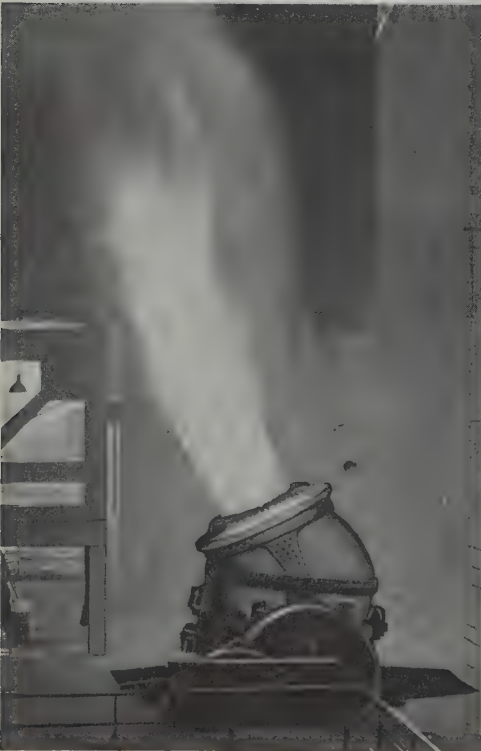
Melting of pig iron in cupola furnaces.

Courtesy A. M. Byers Company

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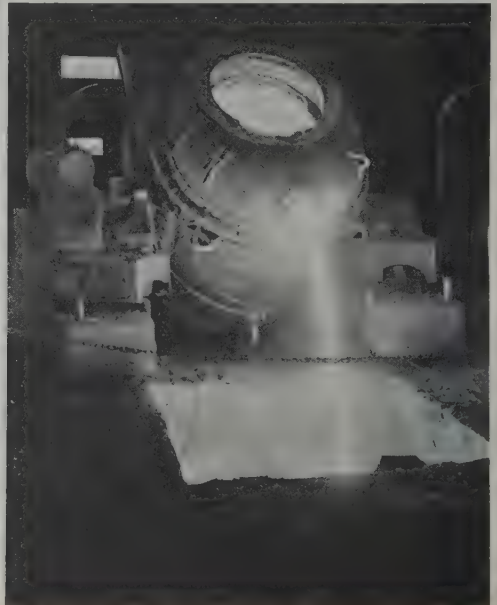
Above: Melting of slag in a tilting open hearth



Bottom left: Refining of molten iron in a Bessemer converter.

Bottom right: Pouring the molten refined iron into liquid slag.

Courtesy A. M. Byers Company



powdered iron and Swedish sponge iron, are the commercial exceptions, but in very small tonnages. The name "pig iron" was applied first to solid pig iron because it was cast in a sand pig bed where the molten iron ran through a long groove or trough and thence into many smaller grooves at right angles, so that it looked like a litter of pigs nursing at the side of the mother sow. When the iron solidified, the long piece became the "sow" and the offshoots became the "pigs" that had been molded in the sand "pig bed." When cast iron molds, or "chill beds," replaced the sand pig bed (which had to be made up after each cast), the names sow and pigs followed the solid pig iron. When the iron from the furnace was poured into a pig machine, there were no longer any sows and all the pig iron became "iron in pigs." Pig beds are becoming obsolete, but pig iron is the commercial and technical name given to this important metal whether it is in its liquid or in its solid form. Iron in pigs is the name given by the United States Tariff Commission to solid pig iron; "hot metal," or "direct metal" is the name given by iron and steel men to the molten metal as it is conveyed from the blast furnace to the steel mill or to the foundry for "direct castings."

Contrary to the decision once announced by the United States Tariff Commission, "that molten iron is not an article of commerce," much molten iron is carried on standard railroads, over rivers, between different towns and companies, as well as between various departments of the same steel company. Metallurgically there is no reason why hot metal could not be transported across the boundary lines of adjoining countries, such as across the St. Mary's River from the Canadian "Soo," or across the Rio Grande at Piedras Negras, Texas, into Mexico. Hot metal is delivered directly from "merchant" blast furnaces to large foundries, making such heavy castings as ingot molds or cast iron pipe.

A "merchant" blast furnace is one that makes pig iron for foundries and sells it on the open market; a "steel plant" or "captive" blast furnace produces steel-making pig iron, usually basic or Bessemer iron.

Where smaller castings are made in large quantities, like engine blocks for automobiles, it is sometimes the practice to pour the hot metal from the blast furnace into a hot metal mixer. Usually molten scrap (cast iron and steel) from a cupola is mixed with the hot metal from the mixer, and the two streams of molten metal flow into a receiver that is continually kept at the right temperature for pouring into the molds. The analysis of the molten metal in the receiver is controlled by mixing the right amounts of hot metal from the mixer and from the cupola.

There are many grades of pig iron classified chiefly by the chemical analysis, especially the phosphorus content, partly by the subsequent use, and also by the blast furnace fuel used in its production. The General Technical Committee of the American Iron and Steel Institute has selected 14 grades of pig iron listed below as representing compositions of proven merit and in extensive use for a wide variety of purposes. Such irons are called standard grades of pig iron.

It is recognized that compositions other than those listed in the tables of irons may be produced and will at times be required for specialized uses. Irons so specified are termed

nonstandard irons.

For convenient reference, standard grades of pig iron listed herein are designated by the use of prefix letters, suffix letters, and numerals. A prefix letter is used which designates grades in order of increasing phosphorus content, as follows:

Designation	Phosphorus content
LP Low-phosphorus	0.035 per cent, maximum
LPi Intermediate low-phosphorus	0.036 to 0.075 per cent
Bes Bessemer	0.076 to 0.100 per cent
M Malleable	0.101 to 0.300 per cent
B Basic—Northern	0.400 per cent, maximum
F1 Foundry—Northern low-phosphorus	0.300 to 0.500 per cent
Fh Foundry—Northern high-phosphorus	0.501 to 0.700 per cent
Fs Foundry—Southern	0.700 to 0.900 per cent
Bs Basic—Southern	0.700 to 0.900 per cent
Cn Charcoal iron—Northern	0.100 to 0.200 per cent
C1 Charcoal iron—Southern	0.035 per cent, maximum
C2 Charcoal iron—Southern	0.100 to 0.200 per cent
C3 Charcoal iron—Southern	0.400 to 0.700 per cent
S Silvery	0.300 per cent, maximum

Silicon and manganese contents are designated by a six-number system in which the first three numerals designate the average silicon content; the average manganese content is similarly indicated by the last three numerals. For example, in LP 113088, LP denotes phosphorus content of 0.035 maximum; 113 denotes silicon content of 1.00 to 1.25 per cent; and 088 denotes manganese content of 0.76 to 1.00 per cent.

The four preceding paragraphs are quoted from pages 3 and 4 of Section 1 of *Steel Products Manual Pig Iron and Ferroalloys*; then there follow 31 pages, with 15 tables of the intricate variations of pig iron that can be made in a blast furnace, having different combinations of the four chief elements, silicon, sulphur, phosphorus, and manganese. The ferroalloys commonly made in a blast furnace are spiegeleisen, ferromanganese, ferrosilicon, and ferrophosphorus. Other ferroalloys with commercial grades are ferrosilicon, silicomanganese, ferrochromium, ferrovanadium, ferrotungsten, ferromolybdenum, and ferrotitanium.

All of the above pig irons, made with coke, are sold and graded on chemical analysis; grading and selling by "fracture" is obsolete. Charcoal pig iron was sold and graded on "fracture" for the past 300 years in the United States, but now there are no more charcoal blast furnaces in the latter country that make sand-cast pig iron; the only charcoal blast furnace left uses a pig casting machine and the iron is sold on analysis. This makes obsolete the 15 grades of charcoal pig iron that prevailed up to World War II.

The market price of charcoal pig iron has always been higher than that of any other grade, beginning with quotations of anthracite and charcoal pig iron in Philadelphia in May 1842. (For about 200 years previously there had been nothing but charcoal pig iron made in this country; in 1946, only coke pig iron and charcoal pig iron were made.) The premium on charcoal pig iron for about 20 years previous to World War II averaged \$7 per ton above similar grades of coke pig iron; this premium was doubled during the war, owing to the scarcity of charcoal pig iron.

Actual market prices of pig iron will not be given here; they can be found in such trade journals as *The Iron Age* and *Steel*. There are silicon differentials, not to exceed 50 cents per ton for each 0.25 per cent silicon content above

the base grade, which is 1.75-2.25 per cent.

In some iron ores, especially those imported from the shores and islands of the Mediterranean, there are small amounts of metals that give trouble in smelting, such as zinc, lead, and arsenic; the zinc and lead do not go into the pig iron, but arsenic does and gives trouble in the subsequent steel. Small amounts of vanadium, nickel, and copper in the iron ores go into the pig iron with beneficial results.

Blast Furnace.—The iron blast furnace (see illus.) is the largest of metallurgical furnaces. In principle, it is one of the simplest means of separating a metal from its oxides and producing a commercial product. In practice, it is a complicated apparatus for handling large tonnages of solid materials, tremendous volumes of cold and hot atmospheric air and still larger volumes of hot gases, for furnishing the room in which a multiplicity of chemical reactions and physical changes can take place at the same time, and for providing a hearth, or crucible, where the molten metallic and nonmetallic products can be received, separated and drawn off, separately, at stated intervals. The blast furnace itself is a vertical series of steel-clad cylinders lined with refractories, through which a continual flow of solids is descending from top to bottom, meeting a continual flow of hot gases ascending from bottom to top, and then outside. Down through this gigantic heat exchanger, which sometimes is 105 feet high from the iron notch to the top, passes a column of several thousand tons of ore, coke, and limestone in 24 hours, all of which is gasified or liquefied by the time it reaches the hearth of the furnace. Up this vertical furnace is blown a hurricane of hot gas that began with 60,000 to 90,000 cubic feet of atmospheric air per minute. Here is one of the paradoxes of blast furnace practice. A big modern blast furnace has a cubical capacity of 35,000 to 45,000 cubic feet; in operation, it is filled up to the stock line with solid iron ore, coke and limestone, and yet a volume of air blast equal to twice its cubical contents is blown into it every minute. Thus there is a descending column of cold solids, getting hotter every minute, meeting an ascending column of hot gases, getting cooler every minute. In addition to the physical phenomena of the exchange of heat, the working of gravity, the calcining of limestone, the roasting of ore, and the diffusion of gases, there are chemical actions and reactions of reduction, oxidation, solution, carbon impregnation, slag formation, sulphur absorption and sulphur removal, and, incidentally and only for a short interval, the formation of the sponge iron which quickly absorbs carbon and becomes the more fusible pig iron, the final product of the iron blast furnace.

Previous to World War I there was no rule for determining the capacity of an iron blast furnace, and 600 tons of pig iron per 24 hours was about the maximum production. In October 1920, the Southern Ohio Pig Iron & Coke Association, after two years of work by a special committee, announced a rule for calculating the capacity of a blast furnace, as follows: "Regardless of grade of pig iron produced, blast furnaces of modern construction should burn about the same amount of fuel daily under same operating conditions. For each grade of pig iron the tonnage which can be produced will depend upon the quality of fuel used, yield of ore mixture

and blast temperature. The tonnage of coke which can be burned in a unit of time has a certain ratio to the working volume of the furnace. The working volume is taken as volume from center line of tuyeres to two feet below bell when closed . . . It has been found that, with good practice, 60 pounds of coke can be burnt each 24 hours per cubic foot working volume . . . It is necessary to adopt a base coke, a base theoretical yield ore mixture, and a base hot blast temperature and then make allowances for variations as encountered."

The analysis of the base coke referred to is as follows:

	Per cent
Fixed carbon	89
Sulphur	1 (maximum)
Ash	9 to 10
Volatile	1 to 2

The structure of the coke is tough, but not dense or fragile, and free from breeze.

By the year 1930 the output of a standard sized blast furnace was 1,000 tons of pig iron per 24 hours; during World War II, it was 1,500 tons, with a few actually making 1,700 tons at times, with a maximum for a day of 1,976 tons.

The main parts of a blast furnace are: (1) the hearth or crucible where the molten iron and slag collect; (2) the tuyere zone where the air blast enters and combustion takes place; (3) the bosh or zone of fusion; (4) the shaft with its upper and lower zones of reduction and its exchange of heat from ascending hot gases to the descending column of solid raw materials; (5) and the top with its receiving hopper, double bells and hoppers, revolving top, downcomer arches for the escaping gases, and uptakes and bleeders to relieve any sudden extra gas pressure inside the furnace. In order to get the optimum results as to tonnage, all of these parts must have the proper dimensions, angles, and locations. These are called the lines of the furnace.

All these sections of the furnace are encased in steel plates, of strength and thickness requisite for the demands of the expansion from heat and pressures inside the furnace. Each section is lined with firebrick and other refractories, suitable for the demands of that section, such as: excessive temperatures and the chemical and physical action of large quantities of molten iron and slag in the hearth; intense heat and evolution of hot gases in the bosh; the wear of the slowly descending solid materials and the abrasive action of the rapidly ascending, dust-laden, hot gases in the shaft; and the wear from impact of the cold raw materials that are dropped off the big charging bell at the top of the furnace, and where there is danger from the chemical, as well as the physical, action of the swiftly moving hot gases. In order to protect these several kinds of refractory linings, and to extend the life of the whole lining of the furnace, many devices are used, mostly hollow water-cooled iron, or copper, plates or castings. Naturally, the hearth needs the greatest protection, because at times it will contain several hundred tons of molten iron, and slag, at maximum temperatures of slag approximately 2800° F.

Besides using the highest grade of firebrick, burned at high temperatures in the brick kiln and machine-ground to exact size, sometimes in the larger furnaces a layer of sillimanite is spread

across the hearth between the courses of the bottom blocks (firebrick 18" by 9" by 6"). Between the firebrick solid bottom, the firebrick side walls, and the heavy steel hearth jacket, there are placed cast iron, water-cooled, vertical hearth plates extending the total height of the jacket. At the tuyere zone there are the copper water-cooled tuyere coolers and also many copper (generally called "bronze") bosh plates above, below and between the tuyere coolers. The bosh walls are protected on the outside by heavy steel bosh bands, or else enclosed entirely by a steel bosh jacket; in either case there are several rows of copper ("bronze") bosh plates, through which flows a constant stream of water. The shaft of the furnace, extending from the mantle to the top platform, has a steel shell outside the brick lining. Between the brick and the steel there is usually some packing that acts as insulation and also as an expansion joint. The brick lining of the shaft, mostly of inwall brick, is sometimes protected by cooling plates of either copper or of water-cooled cast iron plates. The firebrick at the top of the furnace consists of very hard, dense brick, generally protected at the stock line, and for several feet below, by some sort of armor, either of steel or cast iron.

The waste gas ("top gas," or blast furnace gas) from the top of the furnace, amounting in volume as it passes out of the furnace to about 30 per cent more than the volume of atmospheric air blown into the furnace, goes through one or more downcomers extending downward from the top of the furnace to the dustcatcher, where the heavier particles of the flue dust are removed from the hot (250°-450° F.) dry gas, and thence to some form of gas washer, scrubbers and dryers. The final gas is cleaner than the air we breathe, the dust being reduced from about 10 grains per cubic foot down to less than 0.01 grain of dust per cubic foot.

The cleaned blast furnace gas of about 90-105 Btu. per cubic foot is used for heating the hot blast stoves (20 to 25 per cent) under boilers, underfiring of coke ovens, in gas engines, and sometimes at integrated steel plants it takes the place of producer gas for soaking pits, and reheating furnaces.

Hot Blast Stoves.—The air blast from the blowing engines is heated to a temperature as high as 1600° to 1800° F. in a regenerative hot blast stove made of firebrick checkerwork incased in steel sheets 20 to 25 feet in diameter and 85 to 105 feet high, in which the cleaned waste gas from the furnace has been burning for two hours or more. There must be the right balance of heating surface and brick volume so that the heat from combustion of the gas can be stored up and then given out again to the air blast which flows through the checkerwork in the opposite direction from the hot gas. Usually two, or more, stoves are being heated while one or two stoves are "on the furnace." A three-pass stove will have its individual stack, as seen in the photograph; two-pass stoves have one large draft stack in common.

Hot Metal Ladles.—The hot metal ladles mentioned above are of two general types. One is the upright, short-pour ladle car of 50 to 100 tons capacity on a heavy, underslung, steel frame mounted on two standard railroad trucks. A motor for tilting the ladle is mounted on the frame. The other is the Pollock mixer-type, hot metal ladle car of 100 to 200 tons capacity, as

shown in the accompanying illustration, which can be completely enclosed for safe transportation over standard railroad tracks for considerable distances. Both types of ladles are lined with special ladle brick or with silica "firestone."

Hot Metal Mixers.—At steel plants and at large foundries, the hot metal from successive casts of one or more blast furnaces is poured from the hot metal ladles into a hot metal mixer which is a big, steel enclosed container mounted on trunnions, with a thick firebrick lining, kept hot by a gas or oil flame, and tilted for pouring into the transfer ladles with the same big hook and overhead crane as is used for handling the hot metal ladles. The large, mixer-type, hot metal ladles can be poured directly into the transfer ladles that are used to fill the open hearth steel-making furnaces.

Blast Furnace Practice.—The efficiency of the modern iron blast furnace depends on the time and the regularity of the "through-put" of the raw materials that are charged into the top of the furnace through the revolving top and through the double bell and hopper, and down into the furnace itself. The revolving top distributes the materials regularly onto the "big bell" which is a conical, steel casting suspended by a bell rod connected to the bell beam in such a way that the bell travels vertically downward to deliver the stock (ore, coke, limestone, and scrap) into the furnace, and then travels upward to seat itself tightly on the beveled edge of the big hopper so as to prevent the escape of the blast furnace gas. The little bell is then lowered so that the stock in the little hopper drops onto the big bell. The little bell and hopper are revolved by a mechanism that causes the delivery of the stock onto the big bell in such a predetermined way that the "charges" are delivered evenly around the periphery of the stock line, first a charge of coke and then a charge of ore and limestone, and any scrap that is charged into the furnace. This device is the McKee revolving top. During World War II, these big charging bells reached enormous sizes, some being 1½ feet in diameter and weighing 45,000 pounds.

The raw materials are taken from the ground level to the top of the furnace in the skip cars running on the tracks of a double skip hoist, generally electrically operated, as shown in the photograph. The coke is filled into the skip cars from the coke bins without weighing; all ores and limestone are carefully weighed in a scale car before being dumped into the skip cars.

It is the responsibility of the blast furnace superintendent to see that just the right volume of coke is charged into the furnace during the right intervals of time, that the right weights of iron ore and of limestone follow each charge of coke, and that the right volume of air blast is heated to the right temperature and blown regularly each minute into the furnace at the tuyeres at the right blast pressures.

Because the blast furnacemen of the United States, operating men, executives and engineers, had developed during the period between the two world wars a blast furnace practice that accomplished wonderful results as to big tonnages and operating economies, there grew up what is called "American blast furnace practice." The American designs of blast furnace plants, and the methods for their operation have been spread all over the world, so that by the end of World

War II the big 1,500-1,700 ton furnaces were making pig iron in Russia and India and other countries as well as in the United States. Much of this progress was due to the free exchange of

per cent; Al_2O_3 , 3.45 per cent; CaO , 17.38 per cent; MgO , 0.56 per cent in the dried sample. The natural ores and minerals of iron are as follows:

Name	Classification	Formula	Fe content (per cent)	Sometimes called
Hematite	Ferric oxide (hexagonal)	Fe_2O_3	70.0	Red ore
Magnetite	Magnetic oxide (octahedral)	Fe_3O_4	72.4	Black oxide
Martite	Ferric oxide	Fe_2O_3	70.0	Brown ore
Limonite	Hydroxide	$2\text{Fe}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$	59.8	
Turgite	Hydroxide	$2\text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$	66.2	
Goethite	Hydroxide	$\text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$	62.9	
Siderite	Carbonate	FeCO_3	48.2	
Franklinite	Oxides	$(\text{Fe, Mn, Zn})\text{O} \cdot (\text{Fe, Mn})_2\text{O}_3$	21.0	Spathic iron Franklin ore
Ilmenite	Oxides	$(\text{FeTi})_2\text{O}_3$	variable	Titaniferous magnetite
Chromite	Oxides	FeCrO_3	variable	Black sands
Wolframite	Oxides	$(\text{FeO, MnO})\text{WO}_3$	variable	Iron pyrites
Pyrite	Sulphide	FeS_2	46.7	
Pyrrhotite	Sulphide	FeS_7	variable	Magnetic pyrites
Chalcopyrite	Copper-iron sulphide	CuFeS_2	30.4	Copper pyrites
Marcasite	Sulphide	FeS_2	46.7	White iron pyrites

ideas and experiences of the operating men in such groups as the Southern Ohio Pig Iron & Coke Association (now defunct), The Eastern States Blast Furnace and Coke Oven Association, the Blast Furnace and Coke Association of the Chicago District, and the Iron and Steel Division of the American Institute of Mining and Metallurgical Engineers.

Raw Materials.—The essential raw materials for the production of pig iron are iron ore, fuel, flux, and the air blast. A few places in the world have all these in close proximity, notably the Birmingham District of Alabama. Usually, one or more ingredients are transported long distances by rail and water, as in the case of the Lake Superior iron ores which go hundreds of miles to the blast furnaces using the famous Pittsburgh seam of coal for their coke. The assembling costs of the raw materials is a vital factor in the cost of the pig iron.

Iron Ores.—The iron ores commonly used in the iron blast furnace are the oxides of iron: ferric (Fe_2O_3) and magnetic (Fe_3O_4). These are more abundant than any other iron-bearing minerals. The ferric oxide, usually called hematite, often occurs in various forms of hydrates, or combinations of Fe_2O_3 with fixed proportions of "combined water" (H_2O). The Brown Ores of the South and the Southwest, especially in Alabama and East Texas, are hydrated oxides of iron. The percentage of iron (Fe) that must be in an iron-bearing mineral before it can be classed as a merchantable iron ore varies greatly from 25 per cent to 70 per cent, depending on its capability of being beneficiated before charging into the blast furnace, and on the character of the "gangue" of the iron mineral, that is, the nonmetallic elements that are combined with the iron either chemically or mechanically. The gangue of some iron ores, especially certain ores in Red Mountain, in the Birmingham District of Alabama, contain enough lime and magnesia to flux all the silica and alumina in the gangue of that ore, and even a little left over to flux a part of the ash in the coke. These are called "self-fluxing" ores, and, although the iron content is low, they are very desirable. The ore from Muscoda No. 4 mine is such an ore, with the following analysis: Fe, 35.57 per cent; SiO_2 , 12.38

The iron ores that are compounded with other metals, especially the sulphide ores, must be treated in some way to separate the iron as far as possible from the other ingredients, usually by roasting, before they can be charged into the blast furnace. Besides the natural iron ores mentioned above, there are several iron-bearing byproducts containing enough iron to make it profitable to smelt them in the iron blast furnace. These are:

(1) Blue Billy, the iron oxide residue from roasting sulphide ores; (2) flute dust, the fine dust carried out of the top of the blast furnace, and recovered in the gas cleaning equipment; (3) roll scale, the rich iron oxide obtained while rolling steel in the steel mills; (4) mill cinder, the rich iron slag from the puddling process for making wrought iron; (5) slag, from the open hearth furnaces, Bessemer converters and Spiegel furnaces; (6) borings, turnings, crop ends, stove plate, slag scrap, miscellaneous small iron and steel scrap.

An integrated steel plants (an integrated steel plant includes byproduct coke ovens, blast furnaces, open hearth furnaces or Bessemer converters, and rolling mills) it is usual to send a part, or all, of the open hearth slag to the blast furnaces so as to utilize the fluxing value of the excess lime and magnesia and recover most of the manganese and iron. An ordinary open hearth slag will have 10-16 per cent Fe; 4-7 per cent Mn; 43-48 per cent CaO ; 6-8 per cent MgO ; 12-20 per cent SiO_2 ; 2-8 per cent Al_2O_3 ; 1.50-2.35 per cent P; 0.16-0.22 per cent S. Open hearth furnaces producing ingot iron make a slag much higher in iron and lower in lime. The slag from blast furnaces making spiegel contains enough manganese (about 12 per cent) to make it desirable to smelt with iron ores that are deficient in manganese, such as the Eastern magnetites.

Fuels.—Practically all the pig iron in the world is made with coke, either beehive coke or byproduct coke. The only other fuel in the United States is charcoal. Even in the electric furnace process for making pig iron, solid fuel of either coke or charcoal must be used. Charcoal is the blast furnace fuel used in Brazil. It was the only fuel used in the United States for the first 200 years, up to the use of anthra-

cite in 1840. Anthracite predominated from 1855 to 1875; beehive coke from 1875 to 1919; and byproduct coke from 1919 on. The peak tonnage of charcoal pig iron in the United States was reached in 1890 (628,145 gross tons), with 135 active charcoal blast furnaces, and the production has steadily decreased ever since, with only one charcoal furnace in blast at the end of World War II, and one being built. Anthracite ceased to be a regular blast furnace fuel during World War I. It has been used intermittently, mixed with coke, during coke shortages. It is being used in Italy and Russia. Small amounts of certain kinds of bituminous coals (No. 1 Sharon seam in Ohio) that are noncoking are still used for certain special grades of pig iron, mixed with coke, in the United States, and in Scotland.

In the manufacture of beehive coke from bituminous coking coals, all of the volatile by-products are wasted in the black smoke that arises from the beehive ovens that predominated in the coke industry up to World War I and became almost extinct just previous to World War II. The demand for coke then became so great that many new beehive coke ovens were built in many parts of the country where coking coals were available. Since a part of the coal itself is burned to furnish the heat for the coking process, the yield of coke in the beehive oven is only 62 to 66 per cent, depending on the amount of volatile matter in the coal.

Byproduct coke was first used in the chemical industry where a dense lumpy coke was desired and where the byproducts required complicated chemical processes and costly equipment. The introduction of byproduct coke as a blast furnace fuel proceeded rather slowly, but when prejudice and inexperience were overcome by hearty cooperation of the coke oven men and the blast furnacemen, the great advantage of conserving the volatiles so as to reduce the cost of the coke was recognized, and byproduct coke became the almost universal blast furnace fuel wherever coking coals were available.

The yield of coke in byproduct coke ovens is considerably higher than in beehive ovens, but it is still dependent on the percentages of ash and volatile matter in the coal. A good coal would yield about 1,400 pounds of coke per ton (2,000 pounds) of coal; 100 pounds of coke breeze; 10 gallons of coal tar; 2.8 gallons of motor benzol; 24 pounds of ammonium sulphate; 6,500 cubic feet surplus gas. A good blast furnace coke has about 2 per cent moisture; 89 to 92 per cent fixed carbon; 1.50 to 2.00 per cent volatile matter; 4.50 to 7.00 per cent ash; and not over 0.60 per cent sulphur; coke with over 1.0 per cent sulphur is not standard and is usually subject to a reduction in price. All byproduct coke is screened and sized, the smaller sizes being sold for domestic coke; the size for blast furnace coke varies according to conditions of the supply and the vagaries of blast furnace operators; usually it is coke that passes through screens having openings or mesh 4 inches to 3 inches and remains on screens of 1½ inches to 1 inch mesh. Blast furnace coke should be tough, not dense or fragile, and free from breeze.

Flux.—The smelting of iron ores requires a flux stone, either an almost pure limestone (calcium carbonate, CaCO_3) or a dolomite—a double carbonate of calcium and magnesium (Ca,Mg) CO_3 . Lime (CaO) is essential for the forma-

tion of CaS , calcium sulphide, the very stable compound which removes the sulphur that otherwise would combine with the iron and make an undesirable high-sulphur pig iron. Some magnesia (MgO) is always desirable in a flux stone as it tends to lower the melting temperature of very basic slags. Too much magnesia simply increases the bulk of slag beyond the optimum volume. The ash of the blast furnace fuel and the gangue of the iron ores (the earthy ingredients of the blast furnace "burden") combine with the lime and magnesia and go into the slag. The decrease of efficiency of the fluxing value of the stone will be approximately double the amount of silica and alumina contained in the flux stone.

Slag.—The control of the composition of the slag is of prime importance to the blast furnace superintendent, because the smooth running of the furnace and the quality of the pig iron depend upon it. The temperature of the molten slag (above 2700°F . in making basic iron), which is always higher than that of the molten pig iron (2450° to 2700°), determines the critical temperature of the hearth above which only certain necessary operations of the process can be carried out. (J. E. Johnson, Jr., "The Physical Action of the Blast Furnace," *Transactions, American Institute of Mining and Metallurgical Engineers*, vol. 36, p. 472, 1906.)

The character of the slag is the determining factor in the "personality" of the pig iron, especially as to the controllable limits of silicon, sulphur, and to a certain extent the manganese; it also controls the proportions of combined and graphitic carbons in the pig iron, but not the total carbon.

There are various methods for slag disposal, such as running molten slag direct to dry slag pits alongside the blast furnace, direct to a granulating pit, filled with water, alongside the furnace. It may also run directly into cinder ladles ("slag pots") which are hauled away by a locomotive to dry slag pits at a distance from the furnace, or furnaces, or used for fills along a river bank or in low land. (See article 5, "Wrought Iron" for another use of molten slag.) Several types of cinder ladles are shown in the illustration alongside the cast house wall.

The uses of slag have been increasing greatly since the days when unsightly "slag dumps" were seen near every blast furnace of the 19th century. These dumps are now being reclaimed for making fireproof aggregate, roofing material, or mineral wool. Granulated slag is used for making portland cement by grinding to a slurry, mixing with limestone, and burning in a rotary cement kiln; it is also used for insulating packing, railroad fills, and "making ground" in low lands. Air-dried, solid slag is crushed, screened to different sizes, and sold for making roads, railroad ballast, concrete, and roofing material. Mineral wool is made direct by blowing a jet of steam into the molten slag as it runs from the furnace, or after the solid slag has been melted, in an ordinary cupola with coke. Such mineral wool is so white that it is called "slag wool," and is made into "bats," or pads, and used for insulating in buildings and refrigerators. "Loose wool" is the slag wool in small balls about the size of marbles that can be blown by compressed air inside the walls and roofs of dwellings to insulate them from cold and from hot weather.

In some cities the building code specifies

blast furnace slag as aggregate for reinforced concrete above certain heights; limestone aggregate cannot stand the heat like the slag.

Air Blast.—Of all the materials used in the blast furnace for making a ton of pig iron, the weight of the atmospheric air blown in through the tuyeres for the combustion of the coke is the greatest, as is shown by the following table:

Iron ore—52 per cent Fe.	4,047 lbs.—1,807 gross tons
Coke—8 per cent ash....	1,900 lbs.—0.848 gross tons
Limestone—3 per cent SiO ₂	1,000 lbs.—0.446 gross tons
Solid materials	6,947 lbs.—3.101 gross tons
Air blast	7,942 lbs.—3.545 gross tons
Total materials	14,889 lbs.—6.646 gross tons

Totals per 2,240 pounds pig iron

Generally the air blast comes directly from the atmosphere outside the blowing engine house through pipes to the hoods over the intake valves of the air cylinders of the blowing engines, which may be vertical or horizontal reciprocating engines driven by steam, gas, or electricity. Again, they may be turbo blowers of up to 90,000 cubic feet of air per minute and up to 30 pounds pressure. As far back as the end of the 18th century, the British ironmasters were trying to improve the quality of the air blast when they discovered that their blast furnaces did not make as much pig iron in the hot summer months as in the colder winter months. They overlooked the fact that it is the *weight* of oxygen in the air blast that controls the weight of fuel burned at the tuyeres of the blast furnace, and that the hot air of the summer weighed less per cubic foot than the cooler air in the winter months. Paradoxically, and with due respect to those early researchers, the greatest tonnage of pig iron yet made in a day, a week, and a month was by No. 2 Edgar Thomson blast furnace at Braddock, Pa., in the month of July 1945 (1,976 tons, 12,189 tons, and 50,590 net tons respectively). At the end of another century, James Gayley and David Baker, brilliant and courageous blast furnacemen, experimented on the reduction of the moisture in the air blast. Gayley went so far as to freeze out all the moisture possible by refrigeration with ammonia machines, and patented and operated the Gayley dry-blast process which startled the steel industry with its amazing economies and big tonnages. As blast furnace practice was studied more and more by technical men, it was found that a certain amount of moisture in the blast was essential for the optimum catalytic action of the hydrogen that was dissociated in the tuyere zone. Therefore, there must be a certain amount of moisture in the air blast at all times, and if this certain amount (not less than about three grains of moisture per cubic foot of blast) can be kept constant by air conditioning apparatus, then there will be more regular operation of the furnace and a lower amount of coke per ton of pig iron.

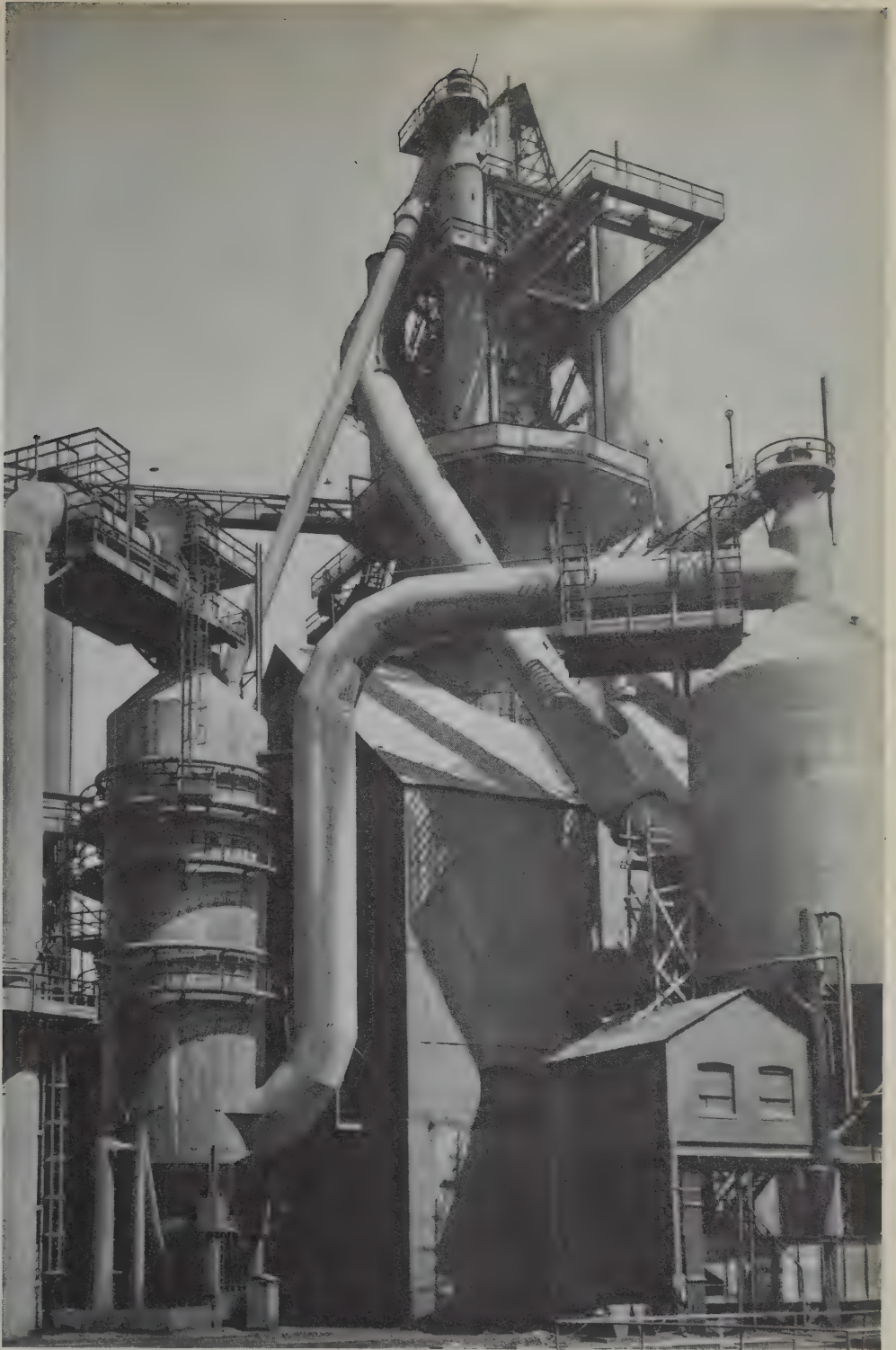
The enriching of the percentage of oxygen in the air blast by removing a part of the nitrogen or by adding oxygen has not yet become standard practice, because no one has yet demonstrated that it would make more or cheaper pig iron. The inert nitrogen of the atmospheric air blast acts as the carrier of the surplus heat of the hearth upward through the descending column of solids which must be brought from the outdoor temperature to the white heat in front of the tuyeres. However, it is not only possible,

but most probable, that a reasonable increase in the percentage of oxygen in the air blast would help to give a higher blast temperature, a lower coke consumption per ton of pig, and increased tonnage, all of which would be debited by the cost of producing the impure oxygen.

Beneficiation of the Raw Materials.—Very few, if any, of the iron ores are charged into the blast furnace just as they come from the mine. Some of the preparation, or beneficiation, may be simply the screening out and crushing of the lumps so as to have the ore more nearly all of the same screen size. In some cases the beneficiation is very elaborate, including crushing, fine grinding, magnetic concentration, tabling, flotation, and sintering. In cases of excessive moisture, iron ores are put through dryers to remove some of the excess water, thus increasing the iron content and decreasing the freight to destination. Iron carbonate ores are roasted, either in rotary or stationary kilns, for removal of most of the carbonic acid gas and making the ore into the richer hematite. Some carbonate ores contain enough iron sulphide so that the ore can be crushed fine and the sulphur used for fuel in a sintering machine. The abundant magnetic iron ores of New York, New Jersey, and Pennsylvania, some of them running as low as 30 per cent in iron, are crushed and ground fine and put through magnetic concentrators that remove most of the gangue and produce a rich magnetic iron ore that is too fine to be put into a blast furnace and must be agglomerated in a sintering machine. It has been found that the famous red ores of Alabama will have to be crushed to smaller sizes than was customary when both the ore and the coke were very cheap in the Birmingham District. In crushing and screening the red ore, much fines are produced and these must be sintered before charging into the blast furnace. Some fine ores are nodulized in a rotary kiln, and some few are biquetted, but sinter gives the best results in the blast furnace. The washing of iron ores which are mixed with clay and sand removes this worthless material and in some cases also removes excess moisture. This is done in "log washers."

Sintering Plant.—Here shown is the exterior of one of the largest of the new sintering plants erected by the United States government during World War II, from a photograph of the Greenawalt sintering plant at Tahawus, N. Y., built for, and operated by, the National Lead Company. The estimated annual capacity is 630,000 net tons of sintered magnetic iron concentrates from the titaniferous iron ore of the famous MacIntyre mine at Sanford Lake; the ilmenite (oxide of titanium) is first removed from the ore. This plant is dust-proof.

Statistics.—The production of pig iron in the United States began in the little charcoal blast furnace in Saugus, Mass., built in 1645. Nothing but charcoal pig iron was made in the United States until 1840 when anthracite was first used. James M. Swank, in his classic, *The Manufacture of Iron in All Ages* (1892), says, "No tabulated statistics of the production of iron in our Colonial history are extant, and the materials for such a compilation appear to be entirely wanting." The census report of 1810 shows 153 blast furnaces and a production of 53,908 tons of cast iron. A chart showing the annual pig iron production, beginning with the year 1810 and continuing through 1933, in the



Courtesy American Iron and Steel Institute

Modern blast furnace with associated gas cleaning and dust recovery equipment.

IRON



Historical development of the manufacture of wrought iron.

Left: Primitive method.

Center left: Ancient method.

Center right: 14th century Catalan forge.

Bottom left: Puddling process, 18th century.

Bottom right: Early 20th century puddling process.



United States according to the fuel used (charcoal, anthracite, raw coal, coke) was published in *The Iron Age* of Nov. 29, 1934 (page 20 et seq.). In comparing statistics of pig iron production, care must be taken as to the number of pounds in a "ton," whether 2,240 or 2,000 pounds.

The American Iron and Steel Institute, New York, has been the authority on pig iron tonnage or production since the days of the American Iron and Steel Association.

The total capacity of the 225 active iron blast furnaces of the United States reached the peak of 66,256,810 net tons in 1945.

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RALPH H. SWEETSER,
Consultant Engineer, *Blast Furnace Practice*.

5. WROUGHT IRON.—In 1934, the Committee A-2 on Wrought Iron of the American Society for Testing Materials defined wrought iron as follows: "A ferrous material aggregated from a solidifying mass of pasty particles of highly refined metallic iron with which, without subsequent fusion, is incorporated a minutely and uniformly distributed quantity of slag."

This definition is based upon metallurgical characteristics and is an amplification of the significance of the title, namely, a malleable ferrous material which may be shaped by a forging or related plastic deformation method. Prior to the development of modern steel-making processes—the Bessemer in 1855 and the open hearth or Siemens-Martin between 1862 and 1868—close metallurgical distinctions were not necessary, since wrought iron was virtually the sole ferrous metal adaptable to a forging operation.

Consideration of wrought iron as an entity involves first, the historical aspect, and second, its place in the more recent and contemporary industrial picture.

History and Development.—The origin of wrought iron may be taken as coincident with the earliest record of ferrous products. The limitations of primitive methods of manufacture undoubtedly resulted in a material conforming to the general characteristics of what we now classify as wrought iron.

Iron has been known from prehistoric times. It is frequently mentioned in Egyptian literature, and some samples in the British Museum are believed to date from 3733 B.C. Iron instruments, tools, and weapons were used in Greece in 1400 B.C. and in Assyria and Italy in 1100 B.C. History records their use in central and western Europe in 1000 B.C., and in Styria and Carinthia before the Christian era. The noted Pillar of Delhi is usually assumed to date from 400 A.D. The use of iron was general in Europe in the Roman Empire, and the heat treatment of weapons and tools was practiced at that time.

The Catalan forge, originated about 1293 A.D. by the iron workers of Catalonia in Spain, represented a major advance in the manufacture of wrought iron direct from the ore. This was a hearth type of furnace consisting of a crucible in which the mixture of ore and fuel was placed. The air blast, produced by means of a trompe or water blower, entered the furnace through tuyeres (nozzles) near the bottom. The efficiency of the Catalan forge, which is said to have produced about 140 pounds of wrought iron in five hours, was considerably higher than that of earlier furnaces. It was in use in the American colonies.

The American bloomery, an offspring of the Catalan forge, represented the highest development of the hearth type of furnace. The hearth was rectangular in shape, with water-cooled metal sides, and was surmounted by a chimney for carrying off the waste gases. A forced hot blast was used, the bellows being driven by a water wheel or steam engine. As in all other direct processes, charcoal was used as a fuel. The bloomery was used in the United States as late as 1901.

Although direct processes for wrought iron production have been abandoned almost completely by the most advanced nations, they are still used by primitive peoples in some parts of the world. In all of these methods through the ages, the reduction of the ore produced an iron with a relatively low metalloidal content, a pasty mass at the temperatures attainable. At the same time the gangue of the ore—silica, and other earthy oxides—formed a fluid slag in combination with some of the iron oxide. The product was a weldable sponge or ball intermingled with some of the slag. This was wrought or forged to a bloom for subsequent fabrication. Aside from the relative primitiveness of method in apparatus, manpower and efficiency, it was necessary to use high purity ore and fuel. There was no control of product through secondary reactions which are characteristic of more modern methods of making iron and steel with quantity output of specification grades from large-scale sources of ore and fuel. In the contemporary era, sporadic attempts along the line of direct reduction are faced with the same limitations of control and flexibility, plus economic and engineering factors in competition with today's two-step practice in the manufacture of iron and steel.

About 1350 in central Europe, a revolutionary transition in the iron industry was instituted. The apparatus developed was known as a *stuck-ofen* and was the progenitor of the modern blast furnace. The development was the result of efforts to reduce the fuel consumption and cost of manufacture by increasing the size and height of the furnace with a shaft type of furnace. There was no thought of a changed product, but the alterations of customary conditions, the somewhat higher temperatures, and the longer and more intimate contact of the charcoal fuel and reducing gases with the metallic iron resulted in a fluid product akin to today's cast or pig iron. Compared with wrought iron, it had a lower melting point, higher fluidity, and was relatively hard and brittle with a granular structure, unlike the fibrous wrought iron. It was of little direct use until the art of casting was developed, but the furnace in the succeeding centuries came into its major role for the production of the pig

iron so important in our modern iron and steel processes.

Throughout the ages, man's greatest need has been for a ferrous product of a malleable, ductile type, which could be formed by plastic deformation, hot or cold, and having a relatively high degree of ductility. With limited use for the cast or pig iron of the *stuckofen* and its offspring, inventive effort was concentrated upon refining the product to the condition of the wrought iron in general demand. An attempt was made to reduce the metalloid content of cast iron (carbon 2.4 per cent, silicon 1.2 per cent) together with manganese and phosphorus, to the characteristics of the forgeable product with metalloid content of the base metal a few hundredths of 1 per cent in each case—notably, in the light of modern metallurgical knowledge, by the virtual elimination of the alloyed carbon.

Charcoal hearths, of which the Walloon, Lancashire, and South Wales are characteristic names, are modifications of the direct reduction hearths. In these forges, known as "fineries," the pig iron was melted with charcoal fuel under the oxidizing influence of a blast issuing from a single or double tuyere. The metal, relieved of its oxidizable metalloids, trickled to the bottom of the hearth and solidified to a spongy mass with slag impregnation and was removed as a wrought iron bloom. These furnaces have been used to produce a so-called charcoal or knobbed iron from iron or steel scrap as a starting metal.

General inefficiency of prevailing equipment and methods and, more particularly, the heavy drain upon timber reserves because of the necessity of charcoal for fuel were a serious handicap to the development of the iron industry. Some relief came in 1730–1735 with Darby's use of coke made from England's abundant coal.

The divorcement from charcoal became complete with the invention, by Henry Cort in England in 1784, of a method which has continued to the present era and is known as the "puddling process." This marked an important epoch in the metallurgy of iron. To make the use of more impure but cheaper fuel possible, Cort proposed to conduct the refining of the pig iron in the hearth of a reverberatory furnace, out of contact with the fuel itself and its contaminating influences. The fuel was burned in a separate firebox, the substance to be treated coming in contact only with the flame and gases resulting from the combustion of the fuel. Cort's hearth was sand-lined, and the process came under the name of "dry puddling." The siliceous hearth caused a heavy waste of iron. Marked improvement came with the introduction of an iron oxide bottom by Joseph Hall in England in 1830. This was the inception of the "wet puddling" or "pig boiling" process. It has remained as the puddling process substantially without change to the present and, prior to the entry of the Bessemer and open hearth processes, it was the bulwark upon which war, industry, and the needs of construction rested.

Puddling.—The puddling furnace is a simple, reverberatory, coal-fired furnace, sometimes with a waste heat boiler in the stack. In the Pittsburgh district, the single furnace was used with a charge of about 600 pounds. It was manned by two puddlers. In the eastern United States, double furnaces were the rule. These were really two single furnaces, back to back, with the walls

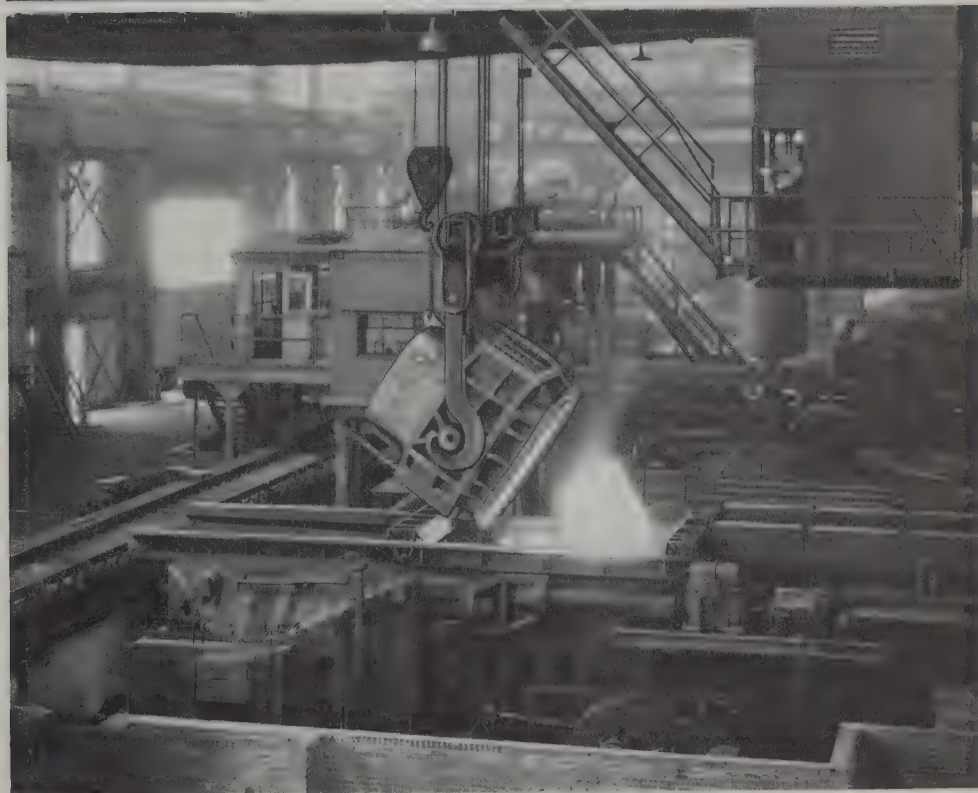
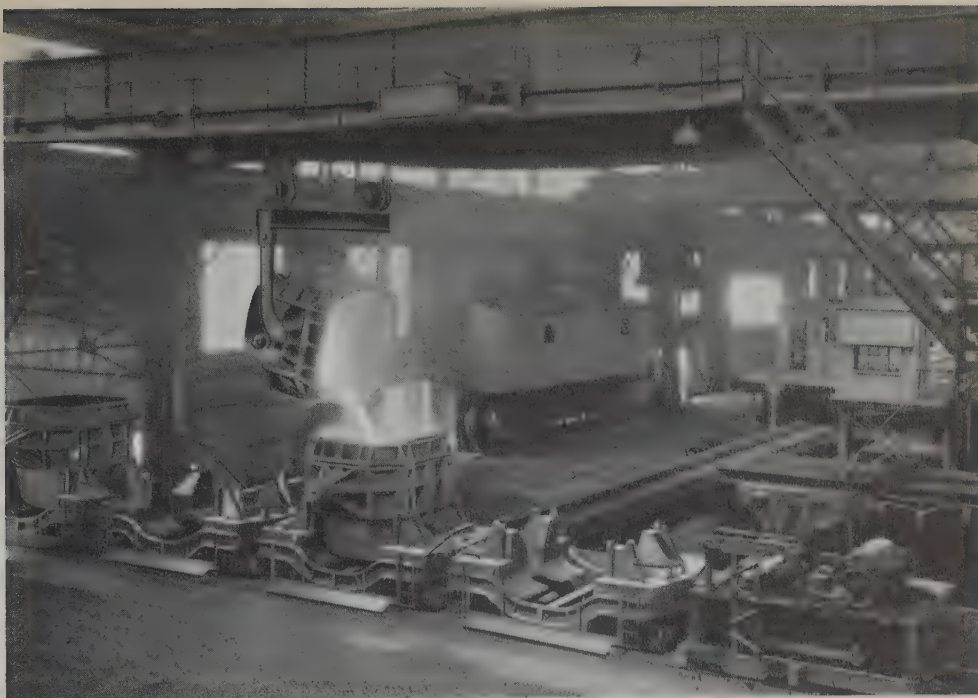
removed to make a single hearth with one stack. The charge of 1,200 to 1,300 pounds was worked by four men, two on each side. The furnaces had a cinder (iron oxide) bottom, and were lined with plastic iron ore. The charge was cold pig iron and required about one and three-quarter hours for completion of the heat. Five heats constituted a turn with a man-turn output of about 1,400 to 1,500 pounds. The fuel requirement with a long flame, bituminous coal was 2,600 to 2,800 pounds per gross ton of product. The furnace temperature was about 2600° F. After the pig iron had become molten, some iron oxide in the form of mill scale was added to the bath. This caused progressive elimination of the undesired metalloids—silicon, carbon, manganese (almost completely), and phosphorus and sulphur to some degree—depending upon operating conditions. The oxides of silicon, manganese, and phosphorus combined with iron oxide from the scale and from the "fettle" (lining) to form a fluid slag of highly basic nature, essentially about 80 to 85 per cent iron oxide and 10 to 15 per cent silica, with small amounts of the oxides of manganese, phosphorus, and aluminum. The carbon, last to be removed, came off as a gas, bubbling through the liquid bath as the so-called "boil." In the final stages of lessened intensity of the boil, the iron "came to mature" and "grained." This was the completion of refining to virtually pure iron, with a melting point considerably above the operating temperature of the furnace and the progressive solidification of the refined metal. Throughout the reaction period and particularly during the boil, the heat was rabbled with long bars through the side door of the furnace, to aid in disintegration of the mass and permit thorough exposure to the refining influences.

The final spongy metallic mass in the liquid slag was compacted into two or three "puddle balls" which were removed from the furnace with tongs, squeezed to a cylindrical bloom, then rolled on the initial heat to rough, rectangular muck bars. In these operations, surplus slag was ejected, and the characteristic fiber of wrought iron was produced by a threadlike elongation of the slag filaments in the metal matrix. For most commodities, the muck bar was sheared to appropriate short lengths, piled, heated to welding, and rolled to desired "single refined" sections. For some commodities, piling and rolling were repeated to obtain greater reductions, finer slag distribution and higher resultant ductility in the product thence classed as "double refined" iron.

Mechanical Puddling.—Prior to the advent of the age of steel, marked by the introduction of the Bessemer and open hearth processes, some attempts were made to attach mechanically operated rables to the puddling furnace to reduce the arduous labor. Also much effort was expended on mechanical puddling, with machines to carry out the entire operation. A conspicuous example in America was the Danks furnace of 1870. Steelmaking was expected to put puddling and wrought iron into oblivion, and efforts for improvement in manufacture waned. Persistent recognition of the merit of wrought iron in certain services, notably against corrosion and fatigue stresses, furthered it despite limitations in manufacture and caused a revival of interest in mechanical puddling.

Mechanical methods have usually employed furnaces of a rotary or oscillatory type, with atten-

IRON



Courtesy A. M. Byers Company

Top: Pouring excess slag from the ladle, leaving a white-hot sponge ball of iron. **Bottom:** Dumping the 7,000-pound sponge ball onto the platform of the 900-ton press, which will squeeze it into a wrought iron bloom.

IRON



Above: Ore conditioning plant where iron ore is crushed and screened into three sizes. The coarse and medium ore goes directly to the blast furnaces. The fine ore is mixed with flue dust from the blast furnaces and is sintered in the building in the right foreground before going to the furnaces. Sintering holds the ore together so that it will not be blown out of the blast furnace as flue dust.



Left: Sinter is broken into small chunks as it slides off the conveyor into the circular hopper via chute at the left. One trip around the hopper cools sinter enough for storage in a pit behind the hopper.

Courtesy (above and left) U.S. Steel Corporation; (below) The William B. Pollock Company

Below: Mixer type of hot metal ladle.



tion focused upon obtaining agitation of the charge in simulation of the manual effort of the puddler. Failures have been caused by inconsistencies in quality of material produced, difficulties of maintenance of equipment, and comparative manufacturing costs unattractive for capital investment. The names of James P. Roe, W. C. Ely, Ford and Henry D. Hibbard have been associated with these methods, some of which reached commercial scales of production.

The revolving furnaces have had their most successful application in "bushelling," that is, heating iron or steel scrap to form a ball which is squeezed and rolled into muck bar for so-called "common iron," a product somewhat below quality grade.

Modern Practice.—An outstanding operation for the production of wrought iron is that of the A. M. Byers Company in the Pittsburgh district. It was the result of a careful study of the metallurgical features of wrought iron, followed by long experimental effort to reproduce the quality characteristics in a controlled and economical manner. The integral steps involved: (1) refining a pig metal charge to a low metalloid content—Bessemer, open hearth or electric steel processes; (2) production of and melting the desired slag, done without difficulty in modified standard furnaces from iron oxide and silica ingredients; (3) disintegration and solidification of the metal and incorporation therein of the desired slag: the crux of the process; (4) compacting the composite mass and squeezing out surplus slag. The result is a product conforming in all respects to characteristics of quality wrought iron. The existing plant began operations in 1930. With the present lack of a blast furnace for supplying direct metal, pig iron of standard Bessemer grade is melted in cupolas. Desulphurization is effectively accomplished with soda ash or caustic soda in the cupola transfer ladle, so that a sulphur content of 0.03 per cent, or lower if desirable, is regularly obtained. This molten pig metal is full blown in 10-ton acid Bessemer vessels to a carbon content of about 0.06 per cent, with silicon and manganese virtually nil.

Shooting.—The required slag conforms to quality wrought iron standards and is melted in a battery of powdered, coal-fired, rotary furnaces. These have replaced the former tilting, open hearth type furnaces. The slag ingredients are roll scale, iron ore, and sand. The molten slag is teemed in the batches required from time to time for the make-up needs of the operation. "Shooting" is the key operation. The blown metal is poured in a steady stream at a rate of one ton per minute into a deep bath of molten slag in large, unlined ladles carried by cars on a circular transfer track. With ample volume of slag at a temperature maintained well below the freezing point of the refined metal, continuous solidification of the metal takes place. Accompanying this is the liberation of all of its dissolved gases with sufficient force to disintegrate the metal and produce a spongy ball of iron, impregnated with the liquid slag. In modern practice the general size of bloom is three to four tons, produced on an approximate 15-minute heat cycle. At appropriate stations the large surplus of slag is decanted into another ladle, and the sponge ball is dumped into a squeezing press. There it is compacted, at welding heat, into a rectangular bloom which, after reheating,

is rolled on a standard blooming mill to billets or slabs. The heat exchange in the shooting operation permits immediate re-use of the decanted slag, with melting only for make-up requirements. The output of modern plant is from 800 to 1,000 tons per day. Most of the product, such as skelp, plate, etc., is rolled from solid sections, in marked contrast to the older wrought iron practice of building muck bar piles. Stay bolts, engine bolts, and locomotive forgings of double refined quality are still rolled from heavy slab piles. The process is under complete control in each of the integral steps and in the chemical and metallurgical characteristics of the materials and product. The wrought iron produced meets all specification requirements and finds outlets as welded pipe, sheets, plates, bars, and forging stock.

Wrought iron finds product applications because of inherent properties of ductility, ease of working and welding, and superior resistance to customary services involving corrosion, shock or fatigue conditions. Mechanized production broadens its horizon if quality standards are maintained.

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6. MALLEABLE IRON.—Malleable iron (malleable cast iron or American malleable cast iron) is a ductile cast metal produced by the heat treatment of a graphite-free cast iron.

History.—Cast iron is easy to produce in any required form by pouring liquid metal into a suitable mold and letting it freeze, but it is without ductility. Wrought iron and steel possess ductility but originally had to be forged to shape. Malleable iron was invented to combine the two properties at a time when steel castings were unknown.

The absence of ductility in cast iron is due to the presence of a relatively large amount of carbon, from 2 per cent to 4 per cent of the metal. This may be present in either or both of two forms: graphite and cementite. The former is the element carbon and in the gray cast irons is present in flakes, resembling crumpled pieces of paper or tin foil. Once present, nothing short of melting can be done to overcome its em-

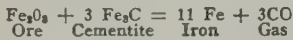
brittling effect on the metal.

Being in flakes, the graphite interrupts the continuity of the metal much more than does an equal amount of graphite in the nodular form found in malleable.

Cementite is an iron carbon compound having three atoms of the former to one of the latter and represented by the symbol of Fe_3C . Its extreme hardness and brittleness account for these properties in white cast iron. This effect can be overcome by heat-treatment.

Two processes have been invented to convert white cast iron, not containing any graphite which would permanently impair ductility, into malleable iron which is reasonably ductile.

The process first discovered in Europe removes the carbon from the metal, reasonably completely. This is accomplished by holding the castings a sufficient time, dependent on their thickness, at temperatures in the neighborhood of 1800°F ., while packed in iron ore. The ore furnishes oxygen which combines with the carbon to form carbon monoxide which escapes as a gas. The reaction:



represents its principle and not its complete sequence of steps. The inventor of the process is no longer known, but it was described by the French physicist René Antoine Ferchault de Réaumur in 1722 without pretense of originality. Such malleable iron is called "white-heart" from the color of its fracture and is still an important article of manufacture in Europe.

On July 4, 1826, Seth Boyden of Newark, N. J. found that he could make a metal which he described in his diary as "dark in color and tougher than any I have yet seen." Since he worked before the days of metallography, he did not know that he was working on a new metallurgical principle, namely, the spontaneous dissociation of iron carbide at temperatures well below the freezing point.



The flaky graphite of gray iron attains its form while crystallizing at a temperature near the freezing point of the alloy where the soft and plastic metallic matrix exercises little or no restraint on its growth into thin platelike forms. In Boyden's process the temperature is low

enough to make the graphite grow in more compact and nearly equiaxed masses called "temper carbon." The product is called "black-heart" malleable and is invariably used in the United States.

Some antiquarian evidence has been offered that black-heart malleable was made in Scandinavia in the 14th century, but the proof is not convincing enough to overcome all doubt.

In modern practice the two processes are not completely separable. The decarburization of the white-heart process is usually accompanied by some graphitization, and the graphitizing reaction in the black-heart process involves some incidental decarburization.

Uses.—In the United States malleable castings are used preponderantly in automotive parts because of their great ease of machining along with strength and ductility. For similar reasons, they are also used very extensively as pipe fittings. Other important uses are in agricultural implements, railway track and trolley parts, certain types of chain belts, and a great multitude of minor applications. The maximum production at the peak of each of the two world wars was approximately at the rate of 1,000,000 tons per year, exclusive of pipe fittings.

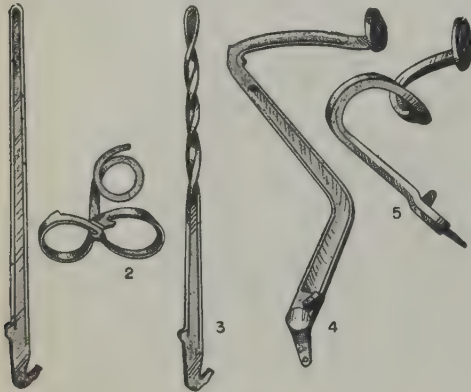
Methods of Manufacture.—In its early experimental stages the white cast iron for malleablizing was produced by melting in crucibles. Rather soon the reverberatory furnace came into use in America for melting the white cast iron. These furnaces grew in size from capacities of 500 or 1,000 pounds to capacities of about 40 tons. Reverberatory furnaces were originally hand fired with coal, but now the use of either pulverized coal or oil mixed with air in suitable burners is practically universal.

To the makers of white-heart malleable, high carbon and sulphur content is not particularly objectionable since the former is to be burned out anyway and the latter retards graphitization, and they have adopted the cupola as a measure of economy. The cupola has also commended itself to the makers of pipe fittings as an economical way to produce sound and leakproof castings.

For automotive, railway, and other uses, lower carbons are desired than the cupola can produce, because the more temper carbon nodules that exist in an object, the weaker it will be. To combine the economy of cupola melting with the convenience it offers of producing a continuous supply of metal, the practice of feeding a reverberatory furnace not with solid iron but with liquid cupola iron and of taking off a steady stream of liquid metal has been adopted.

An alternative is to reduce the carbon and otherwise to adjust the composition of cupola metal in electric furnaces. To these two "duplexing" processes may be added a technique, now discontinued, of mixing cupola metal and liquid Bessemer steel in an electric furnace in a "triplexing" operation.

The white iron castings are then heat-treated. For the white heart process this is almost invariably done by packing them in a mixture of hematite ore, which has been previously used, and some new ore to make up for the oxygen expended during these previous uses. The containers are white cast iron pots or boxes. These are heated to approximately 1800°F . and maintained at this temperature for the requisite time which, for example, may be from 6 to 10 days.



Showing malleability of malleable iron automobile parts.

The time to decarbonize a casting completely is approximately proportional to the square of its thickness. This introduces difficulties when castings of various thicknesses are annealed together, for after the carbon is completely gone, oxidation of the iron must be feared. The matter becomes still worse when a single casting varies greatly in cross section. Attempts were made in 1945 to decarburize in a muffle through which a gas of suitable composition is caused to flow. It is possible to select compositions which will oxidize carbon but not iron, and to produce them by the incomplete burning of coal gas.

The black-heart process requires no chemically active packing since the reaction does not involve any outside agency. Graphitization goes on simultaneously at all points in a casting. Its rate is determined primarily by the rate of diffusion of carbon in iron, which varies with the temperature, and by the number of nodules which can be formed, being a function of grain structure. Both may depend on chemical compositions. Heat treatments represent a holding at 1700° to 1800° F., followed by slow cooling to below the critical point (usually about 1300° F.) and sometimes a subsequent holding of that temperature.

According to the composition, the quality requirements, the size of the annealing furnace charge, and the type of furnace, heat treatments vary widely in time. An overall time of about 24 hours is claimed, although it is unusual; 32 to 44 hours may be encountered; 65 hours is quite common, but muffle furnaces of large capacity may require 6 to 8 days. Since to anneal rapidly, small charges and highly mechanized furnaces are required, there is some incompatibility of low cost and fast times.

The simplest furnaces are similar to those used in the white-heart process: the large brick chambers into which stacks of pots containing castings are set, and into which flame passes from pulverized coal, oil or gas burners. For rapid handling, the bottom of the furnace may be a flat-topped car on which the pots stand. Cars can be pulled out and pushed into a cooler furnace without losing much of the heat contained in the furnace structure.

In continuous kilns, cars loaded with pots pass down a long tunnel, fired at intervals, so that as the charge passes through, it remains at each temperature the desired time. Large castings are often not packed in pots but placed in muffles of firebrick or silicon carbide to protect them from the flame. The muffle is then heated from the outside. In view of the long heat treatments, some means of protecting the castings from too oxidizing gases is necessary.

Chemical Composition.—The composition of the hard iron for conversion into black-heart malleable depends upon many factors. Carbon is adjusted from considerations of strength and may be from 2 per cent to 3 per cent. Silicon is desirable as it accelerates graphitization in annealing, but if too high, will cause "primary" or flaky graphite to form during freezing, and thus ruin the product. Small castings may have more silicon than large ones, since primary graphitization is greater with slow freezing. Silicon may be as high as 1.65 per cent under very favorable circumstances, and as low as 0.90 per cent for many large castings. Manganese is usually adjusted to three times the sulphur and the latter accepted as produced according to the melt-

ing process.

Phosphorus is found in amounts ranging from 0.08 per cent to 0.20 per cent. It strengthens the metal, but a combination of high phosphorus and silicon predisposes the metal to intergranular brittleness under impact. This can be overcome by quenching from 1250° F., but brittleness at sub-zero temperatures will remain.

High carbon and phosphorus make it easier to cast small sections, but the former reduces strength and elongation. Silicon, up to that amount which causes graphitization during freezing, is advantageous because it makes for faster annealing.

The only alloys useful in improving the properties of malleable iron are copper and molybdenum. Small amounts of copper increase the resistance to acid corrosion. Larger amounts, up to 1.50 per cent, increase the strength, especially of high-carbon iron. Copper slightly accelerates the graphitizing rate and is therefore often used in connection with molybdenum, a slight retarder, since both increase the strength of malleable iron.

In white-heart malleable, carbon and silicon control are not so important, provided only that primary graphitization is avoided. Either manganese is kept much lower or sulphur is kept higher than in black-heart. Manganese usually does not exceed the sulphur. Phosphorus is generally kept lower in white-heart than in black-heart, usually below 0.10 per cent.

Mechanical Properties.—Specifications adopted in 1939 by the American Society for Testing Materials for black-heart cupola malleable iron require a tensile strength of 40,000 pounds per square inch, a yield point of 30,000 pounds per square inch, and an elongation of 5 per cent. The same society's specifications, adopted in 1933, and reaffirmed in 1944, provide for two grades. One has a required tensile strength of 50,000 pounds per square inch, a yield point of 32,500 pounds per square inch, and an elongation of 10 per cent; the other, a tensile strength of 53,000 pounds per square inch, a yield strength of 35,000 pounds per square inch, and an elongation of 18 per cent. These properties are inseparably related to a particular form and size of test specimen prescribed and identical for all three specifications.

The grade of lower strength and elongation is the more machinable, and the impact resistance of the two last-named grades is about equal. Malleable iron has very high magnetic permeability and is well suited to magnetic circuits using direct current. Like all unlaminated cores, its eddy current loss is relatively high. Alone among the commercial forms of iron, black-heart malleable's elongation changes directly and not inversely with tensile strength. Its machinability is better than that of any ferrous material of similar ductility.

The mechanical properties of white-heart malleable are described by British specifications adopted in 1927. Round specimens 0.564 inch in diameter are required to have a tensile strength 44,800 pounds per square inch and an elongation of 5 per cent in 2 inches. A bar 1 inch by 3/8 inch in cross section is required to bend 45° around a mandrel of 1-inch radius.

Pearlitic Malleable.—This is a term chosen with insufficient respect for the exact meaning of terms. It is used to designate malleable iron purposely containing combined carbon, whether

this is present as pearlite or in some other metallographic form. These materials are produced by one of three types of processes. Starting with white cast iron identical with that used for black-heart malleable, the annealing cycle may be shortened, particularly near the critical points, in order to leave the desired amount and form of combined carbon. Alternatively, chemical elements retarding the graphitizing process, such as manganese, molybdenum or chromium, may be added to the white molten cast iron as required, in order to produce the desired result, after a normal annealing cycle or a modified one. Lastly, malleable iron may be heated above the critical point, to 1480° F., for example, where graphite will redissolve very quickly in an amount determined by the temperature. The material is then cooled in such a manner as to produce the desired structure.

Since innumerable combinations of techniques are available, it is not unnatural that the properties of these so-called pearlitic malleables will vary widely. All are stronger, less ductile, less machinable, and harder than malleable. All of them are also of higher electrical resistivity and lower magnetic permeability. The ductility which can be had for a given strength depends very largely on the properties of the original, completely annealed malleable in those pearlitic malleables which are produced by reheat-treating that product.

Three quite important types of microstructure are found in the matrix of pearlitic malleable. This matrix, in which the temper carbon is imbedded, consists of two metallic constituents: carbon-free iron or ferrite, and iron car-

bide or cementite. The form of the latter is greatly variable. In some pearlitic malleable the carbide is somewhat uniformly dispersed through the ferrite. In another type the graphite nodules are surrounded by "bull's eyes" of carbide-free ferrite, the remainder of the structure consisting of a somewhat uniform dispersion of carbide in ferrite. In the third type, the matrix consists of ferrite grains, separated by a network of carbide dispersed in ferrite.

As these patterns change, the resulting properties also change greatly. Pearlitic malleables may have ultimate strengths of over 100,000 pounds per square inch with very low elongation, 1 per cent or 2 per cent, for instance. At the other extreme is the correlation of strength and elongation found in ordinary black-heart malleable.

There are no analogues to these pearlitic malleables among the white-heart malleables. If decarburization is there incomplete, the centers of heavy sections are pearlite, in extreme cases interspersed with massive carbides. This condition, however, is not desired and is not tolerated in sections which are to be subject to severe usage.

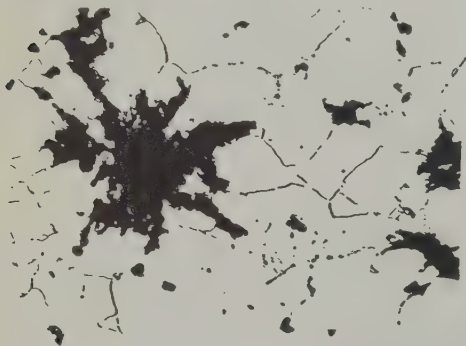
Welding Malleable.—Since black-heart malleable reverts to pearlitic malleable on heating above the critical point, welding processes are limited to procedures involving either the use of very low melting electrodes, which frequently lack strength, or to the use of subsequent, accurately controlled, heat-treatments to undo the effects of reheating in welding. Completely decarbonized, white-heart malleable can be welded in the forge fire or by any of the methods applicable to low-carbon steels.

Graphitizable Steel.—Since about 1937, alloys which are sufficiently low in carbon as to be properly classified as steel and high enough in silicon to graphitize readily have come into use. Their composition may be about 1 per cent carbon and 1.25 per cent silicon. They are most frequently used in modifications analogous to the pearlitic malleables and find their principal application in automotive construction.

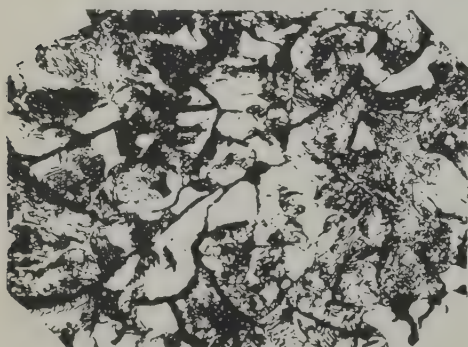
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7. ORIGIN OF IRON ORES.—Iron ores are those parts of the earth's crust from which iron can be extracted at a profit. Whether or not an iron-bearing rock is ore depends upon many factors, chief among which is the demand as reflected by the price of ore. As the price goes up, materials that were formerly not ore, either



Magnified structure of malleable iron, showing nodular carbon.



Magnified structure of pearlitic malleable iron.

because of their low quality, undesirable impurities, unfavorable geographic situation, or for other reasons, become valuable. New methods and techniques for cheaper mining and better recovery also result in lower per-unit costs. Thus the rock of today is the ore of tomorrow. Iron ore is a cheap commodity that is handled in bulk. Because of this fact the size of the ore bodies is of prime importance, as the unit cost of handling large tonnages is considerably less than it is for small amounts. The presence of impurities such as silica, nickel, chromium, and copper, even in small amounts, frequently determines whether or not a material is ore.

Iron Formation.—The term "iron formation" is used in reference to a banded or layered iron-rich rock of sedimentary origin. In the Lake Superior region this formation is called taconite, and in Brazil it goes by the name of itabirite. The individual beds or layers are generally less than one inch thick and consist of chert (silica) and an iron-rich mineral—oxide, carbonate, sulphide, or silicate. In places the individual layers gradually disappear. The rock grades into ferruginous shale or slate, or into quartzitic beds, and locally into massive hematite.

Iron formation is widely distributed throughout the world. Some of the better known districts include the Lake Superior region in the United States and Canada, the Ungava Bay region in Labrador and Quebec, El Pao and Cerro Bolívar in Venezuela, the Brazilian deposits near Belo Horizonte in the State of Minas Gerais and near Corumbá in the State of Mato Grosso, the Bomi Hills in Liberia and elsewhere in Africa, in India, the Yampi Sound in Western Australia, in Manchuria, and at Krivoi Rog in the Soviet Union.

Most geologists agree that the layered character and other features of the iron formation indicate a sedimentary origin. Four principal theories have been advanced to explain the accumulation of the iron-rich sediments: (1) The silica and iron accompanied volcanism and probably came from magmatic springs that were poured out on the sea floor. (2) Iron and silica were brought in solution from a nearby land mass and were rhythmically deposited as sediments in water, probably as a consequence of seasonal variations in the composition of the water. Deposition resulted either by direct chemical precipitation of silica and iron or by organic agencies. (3) The beds were originally deposited as fine-grained ferruginous tuffs and other normal sediments. The beds were silicified, more or less contemporaneously with their deposition, and gave rise to banded cherts and jaspers. The cherty nature of the silica was determined by the low-temperature conditions of deposition. (4) The iron formation represents accumulations in a partly enclosed basin, and precipitation and character of the sediment were controlled by oxidation-reduction conditions.

The ultimate source of the millions of tons of iron included in these rocks may have been the interior of the earth, from which iron-bearing waters were ejected during volcanic activities, or the iron may have been contributed to the sea by streams which received their iron from deeply weathered land masses. Iron formation is ordinarily not ore because the silica content is too high and the iron content, which ordinarily ranges between 15 and 35 per cent, is too low for profitable mining.

In nature, iron formation is converted to iron ore in any of several ways. Under conditions of tropical weathering, silica, being more soluble than iron, is slowly removed and leaves behind a deposit of high-grade iron ore. Leaching of silica is also accomplished by warm water that accompanies volcanic and similar igneous activities in the earth. Where iron formation has been deeply buried and subjected to mountain-making forces, the iron and silica locally separate, and the iron may be concentrated in masses of hard, compact ore. Where iron formation is partly weathered and is softened, the silica particles are easily separated by screening or by jigging, and a useful concentrate is recovered.

Taconite.—The iron formation or taconite of the Lake Superior region, and especially the hard siliceous and partly magnetic taconite of the eastern Mesabi Range in Minnesota, has long presented a challenge to the iron and steel industry. Here is a tremendous supply of at least five billion tons of low-grade iron-bearing rock readily available to existing transportation and smelting facilities. This hard tough taconite cannot be drilled effectively by ordinary methods, and only within recent years has a new method of drilling, called jet piercing, been developed. In this method, jets of flame, produced by a mixture of oxygen and petroleum base fuel, spurt from a rocket-type burner and cause the rock to chip. Steam from cooling water flowing to the burner flushes away the flakes as the drilling progresses. On the average, jet piercing drills a 6½-inch hole about 15 feet an hour in the hard taconite.

After blasting, the taconite is finely ground and is concentrated magnetically to a powder that contains 60-65 per cent of iron. The fine powder, dampened, is put into a rotating drum, from which emerges a stream of mud balls or pellets, each about one inch in diameter. After burning at a high temperature to assure that they will not dry out and crumble, the pellets are ready for the blast furnaces. They form an ideal furnace feed and are much sought after. The recovery of the iron in magnetic taconites assures the Lake Superior region of a long period of mining activity after the rich soft ores are exhausted.

The principal difficulties in the way of development of the taconite industry are the many millions of dollars and the length of time required to construct large recovery plants. Another factor in the taconite industry is that production of pellets cannot be rapidly expanded during times of pressing economic need. While the recovery of magnetic taconite will continue to expand the process of treatment will be improved, the demands for iron and steel are so tremendous that ore necessarily will be obtained from all available sources. Magnetic taconite will furnish a steadily growing supply of high-grade material to the blast furnaces, but alone will not be an adequate substitute for the larger and more easily handled soft-ore bodies.

At the Republic and Humboldt mines in the Marquette Range, hard siliceous hematite-bearing taconites known as jasper ore are being mined. After grinding, the hematite is concentrated by a froth-flotation process. The concentrates are then pelletized in much the same manner as the magnetic taconite. The wash ore that was formerly produced in considerable amounts from the western Mesabi Range is another form of partly weathered taconite. Wash ore is super-

ficial material, softened and partly decomposed by weathering processes. It is cheaply mined, then flushed through a screen where coarse silica and the very fine particles are removed. The resulting washed product is a good grade of ore. Other types of taconite, including those in which the iron is in the form of sulphide, silicate, and most of the nonmagnetic oxides, are not at present commercial. The Lake Superior region is the only place in the world where mining and pelletizing of taconites is being done on an appreciable scale.

Oölitic Iron Ores.—Oölitic ores are so called from their resemblance to fish roe. They vary in size up to a diameter of about $\frac{1}{8}$ inch, and commonly show concentric layers around cores of sand or shell fragments. A radial fibrous crystal structure, is exhibited by many oölitic. The oölitic iron ores were deposited in shallow lagoons where sand and shell fragments were plentiful. The water, discharged from the weathering land masses, contained iron bicarbonate and possibly colloidal iron, which were rapidly precipitated in the sea. Hematite, chamosite, and siderite replaced limy oölitic and shell fragments, coating grains of sand and other materials. Among the larger oölitic iron ore deposits are the minette ores of Lorraine and Luxembourg, the Clinton ores of the eastern United States, the Cleveland Hills deposits (Yorkshire, England), and those of the Wabana district in Newfoundland.

The minette ores are brown, yellow, or gray, and are soft and earthy. They form several beds interlayered with shales, sands, and marls. Many of the oölitic consist of limonite and hematite, but others are siderite and chlorite, cemented by a fine-grained matrix of the same minerals. The iron is derived from adjacent land masses and carried to the sea; according to one group of geologists, the iron has replaced the calcium in limy oölitic. Other geologists believe that the oölitic were originally iron carbonate (the mineral siderite) and later were changed to the oxides.

The Clinton ores are best developed in Alabama, but they extend northward irregularly through New York State. They are bright red and, as with the minettes, contain considerable lime. The Clinton oölitic ore consists of small grains of hematite in a lime matrix. Many individual oölitic have cores of sand. Other types of ore associated with the oölitic in the Clinton beds include flaxseed ore, fossil ore, and sandstone ore. The flaxseed ore contains small flat hematite grains about the size and shape of flax seeds. The fossil ore consists largely of fossil fragments coated by, or replaced by, hematite. In the sandstone ore each sand grain is coated with hematite and the grains are cemented by hematite and calcite. The ore was formed by direct precipitation from sea waters. Iron was carried by streams into shallow marine basins and there was slowly precipitated around shells and sand grains. Near the surface, where weathering processes are active, the ores are soft and are easily mined. In depth they are somewhat more siliceous and are harder.

The ores of the Cleveland Hills district in England are shallow marine deposits composed of oölitic of chamosite and grains of siderite in fine-grained chamosite. Originally the ores formed a muddy shoreline in the sea. The Wabana ores are oölitic of hematite and chamosite in a matrix of siderite and other

minerals. Borings of algae penetrate both the oölitic and the matrix. The ore is a shallow marine deposit that was in its present condition before being buried under other sediments.

Other Sedimentary Ores.—Ores such as those of the Watenstedt-Salzgitter area in Germany are believed to be of shallow marine origin, though they do not show oölitic structures. Other marine deposits include the low-grade iron carbonate beds or black band ores of England and the eastern United States.

Magmatic Segregation Deposits.—As molten rocks (magmas) within the earth cool, crystals are formed and settle in the chamber occupied by the molten materials. These crystals in places are iron-rich minerals, and after the magma has cooled and the rock is elevated to the surface of the earth, they accumulate locally in layers rich enough to mine. Such layers, formed by crystal settling, by convection currents, or by other processes of concentration within the magma, are called magmatic segregation deposits. The titanium-rich iron ores of the Allard Lake district, Canada, are of this type.

Other iron ores are closely related to magmatic segregation deposits. After crystallization in a magma has proceeded nearly to completion, it is possible that considerable iron is left in the residual fluid, which rises to the top of the magma chamber. As cooling continues, the fluid fills the interstices among the crystals near the top of the cooling mass. After solidification, the interstitial material may contain sufficient iron to be ore. Such is possibly the origin of part of the magnetite ore bodies in the Adirondack region of New York State. Where the final residual liquid, rich in iron, escapes from the solidifying magma and is forced upward by pressure, it is injected into the overlying rocks, and locally forms iron ore. The rich deposits of Kiruna and Gällivare, Sweden, have formed in this manner. They are called magmatic injection deposits.

Black Sands.—Heavy resistant black sands accumulate along many beaches and sand bars. Sands of this type are accumulating today wherever water sorting along streams or beaches takes place. Black sands are known to have formed throughout geologic time, and the old deposits are known as "fossil" beaches and bars. The most prominent constituents of the sands are probably magnetite and hematite, though ilmenite is also common, along with other heavy resistant minerals. Owing to the presence of impurities and to the shallow depths of many deposits in comparison to their surficial extent, the economic value of most sands has been slight. In few places can they be mined economically from iron. Small amounts are recovered from the titaniferous beach sands of northern Honshu and Hokkaido for use in the steel industry of Japan.

Pyrite.—The sulphides of iron, pyrite and pyrrhotite, are widely used in the manufacture of sulphuric acid. The ores are burned, and sulphur is removed as a gas. The residues are fine-grained red powder that ordinarily contain 60 per cent or more of iron. After being sintered to a hard porous clinker, the material is an excellent furnace feed. Sinter of this kind is used in many places. In Japan about one million tons of sinter are used annually in the steel industry, and sinter also forms an important part of the raw material used in European iron and steel mills.

Igneous Metamorphic Deposits.—During cooling of a molten rock or magma, the light

watery constituents escape into the bordering solid rocks. These watery fluids, known as mineralizers, carry iron and other elements with them. Where they encounter favorable chemical and physical conditions in the surrounding rocks, iron is precipitated, principally as the oxides magnetite and hematite, or as the sulphide pyrite. Complex silicate minerals, such as the garnets and hedenbergite, are commonly found with the iron minerals. Deposits formed in this manner are distributed in the country rock around the borders of the crystalline materials. Because of their location they are called igneous metamorphic or contact metamorphic deposits. The iron ores at Cornwall, Pa., are of this type. Here iron ore replaces limestone and limy shale along the line of contact with a dark crystalline intrusive rock called diabase. At Cedar City, Utah, similar conditions are found. The ore is in limestone at the line of contact with a granitoid rock called quartz monzonite. Here iron-rich minerals in parts of the quartz monzonite were altered, and the iron was redissolved in the residual magmatic fluids. These fluids migrated from the intrusive masses outward and upward into the lower energy levels of the surrounding rocks, where they reacted with the limestones and deposited the iron.

Replacement Deposits.—Where iron-bearing fluids migrate through the earth and encounter environments favorable for chemical reaction, the rocks are dissolved and carried away in solution. In their place the iron minerals are deposited. Where deposition follows solution so closely that the original textures and structures are preserved, the deposits are known as replacement deposits. Either hot or cold waters that traverse iron-bearing rocks readily become laden with iron salts. The Steep Rock Lake deposit in Ontario and several of the better ore bodies in the State of Minas Gerais, Brazil, are replacement deposits formed where iron-bearing waters encountered environments favorable for deposition.

Spring Deposits and Bog Ores.—Reddish brown to yellow hydrous iron oxides are deposited at the orifices of many springs and also accumulate slowly in bogs and swampy places. These deposits are generally small and of minor economic value, although a spring deposit at Kuchan, Hokkaido, was of great local value and yielded more than five million tons of ore. Both spring ores and bog ores commonly contain sand grains and other impurities and are high in phosphorus. Limonite is carried in solution with carbon dioxide (CO_2), humic acids, or sulphuric acid derived from the oxidation of sulphide minerals. It is readily precipitated by the loss of CO_2 or by the neutralization of the acid. It forms thin iridescent films on quiet water, which are frequently mistaken for oil.

Weathering Processes.—Any iron-bearing rock exposed at the surface of the earth is subjected to atmospheric attack. The more soluble constituents are removed, and iron in the form of limonite accumulates along the outcrops. In places this limonite has been mined for ore, and exposures of weathered sulphide deposits have been especially worthwhile. A deposit of this type was mined at Ducktown, Tenn. At Cartersville, Ga., the ochre and amber, sought for use in the manufacture of pigments, are fine-grained mixtures of limonite and clay that were left in pockets on the rough surfaces of the rock at the base of the zone of weathering.

Laterite.—Residual mantles of iron-rich soil,

called laterite, are found in many places in the tropics. They have been mined locally, though in general they are of small economic value in the iron-ore industry. Laterites ordinarily consist of iron oxide pellets one inch or less in diameter, scattered through dark red to yellow soil rich in iron. They are residual materials left after the long-continued weathering of iron-rich rocks in warm and humid climates. Laterites are porous bulky ores that contain much water and generally have about 30 to 45 per cent of iron, though exceptional ores contain more. Because of their low grade, and especially because of their water and irregular contents of chromium and nickel, laterites are not now used in blast furnaces. Nickel is recovered from laterites in New Caledonia, at Nicaro in Cuba, and at Riddle, Ore., though the iron is not used. With the depletion of the high-grade ores of the Lake Superior region and with the tremendously increased demands for ore, considerable attention is being given to laterites, and it seems likely that they will become a valuable supply of ore. Many laterites are favorably situated for cheap mining and transportation, and reserve deposits are estimated in many billions of tons. For bibliography, see 9. *World Supplies* (Bibliography).

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8. IRON ORE DISTRICTS OF THE UNITED STATES.—The iron ore industry of the United States was established along the Eastern seaboard during early colonial days. It was based primarily upon brown iron ores that extended along the eastern foothills of the Appalachian Mountains, and upon charcoal that was made near the furnaces. The industry furnished adequate iron and steel for the modest demands of the period. The gradual westward migration of population, increased industrialization, and improvements in ironmaking resulted in greatly increased demands for iron and steel. The Eastern seaboard could no longer fulfill the needs of the country, and as a result iron mining gradually shifted to the larger deposits of the Lake Superior region and to Birmingham, Ala. Large integrated steelmaking centers, using these ores, were established near adequate supplies of coking coal. The great industrial expansion in the United States since World War II and the continuous growth of population have resulted in unprecedented demands for iron and steel. This has resulted in increased production in the East and an even greater expansion in the partly developed Western states. Thriving iron and steel smelting industries exist in Colorado, Texas, Utah, and California. The total iron ore mined in the United States has grown from the small tonnage required in colonial times to about 117 million tons in 1953, and needs continue to expand. Domestic mines have been unable to supply demands, and the United States is becoming increasingly dependent upon foreign ore supplies. Scarcely a deposit of iron-bearing rock in the country has not been examined and explored, and many have been developed.

Lake Superior Region.—The Lake Superior region has been by far the most productive iron ore district in the United States. From its first shipment in 1854, through 1953, the region yielded a total of 2,808,514,542 tons of ore, much of it high grade. Production has come principally from six separate areas or ranges—the Vermilion,

Mesabi, and Cuyuna in Minnesota, the Penokee-Gogebic in Wisconsin and Michigan, and the Menominee and Marquette in Michigan. In addition several smaller deposits, such as those at Republic and Amasa, Mich., and Baraboo, Wis., have contributed to the total production. Ranges in adjoining parts of Canada are also generally included in the Lake Superior region. These are the Michipicoten and the Gunflint, the southern part of which crosses the international boundary into Minnesota. The Steep Rock Lake deposit is also in the Lake Superior region.

The Mesabi range has been by far the most productive. One mine that has probably produced more iron ore than any other in the world is the Hull-Rust-Burt-Sellers open pit. In 1942, its year of maximum production, this pit alone produced 21,535,000 tons of direct shipping ore. On the Mesabi range the iron ores are in the Biwabik formation, which crops out in an east-west direction for nearly 100 miles. Most of the mining has been by open-pit methods and at depths of less than a few hundred feet. The deepest ore mined on the Mesabi range came from a depth of about 900 feet, though elsewhere in the Lake Superior region, as on the Gogebic range, depths up to 4,000 feet have been attained. With the approaching depletion of the rich surface ores, underground mining is assuming greater importance. This is especially true in ranges other than the Mesabi. The change to underground mining takes on special significance in the planning of national defense, as production from underground mines is essentially fixed and cannot be expanded rapidly, as can that from open pits.

The iron ores of the Lake Superior region range widely in their physical and chemical characteristics. They are divided into hard ores and soft ores, each of which is further classified into five types: Bessemer, non-Bessemer, high-phosphorus, manganiferous, and siliceous. Bessemer ore contains less than 0.045 per cent of phosphorus when dried. Non-Bessemer ore contains between 0.045 and 0.180 per cent of phosphorus, and high-phosphorus ore contains between 0.180 and 0.250 per cent. Manganiferous and siliceous ores contain abnormally high percentages of manganese and silica. During the early period of mining much of the ore was of Bessemer grade, but within recent years between two thirds and three fourths of the ore has been of low-phosphorus non-Bessemer type. The iron formation or taconite of the eastern Mesabi Range is a dense, hard, tough rock that contains between 25 and 35 per cent of iron. Where the iron is present as magnetite, extensive development of the deposits is under way. Mining is done in open pits, and production is expected to expand rapidly as treatment plants are completed. Siliceous taconites on the Marquette Range are also being developed, and the iron is concentrated by flotation.

Eastern Ore Deposits.—Birmingham District.—The Clinton formation ranges in thickness from 250 to 500 feet and consists of thin beds of ferruginous sandstone, shale, and oölitic hematite. The formation extends from Alabama northward into New York State and locally contains beds of iron ore that average two to three feet thick. The iron ores attain their maximum thickness in the vicinity of Birmingham, Ala., though Clinton ores have been mined to a lesser extent in Tennessee and elsewhere. Near Birmingham two beds are mined. These each

average between 8 and 20 feet thick and are mined for a distance of about 18 miles along their outcrops. The ore contains a small amount of calcium carbonate and is in part self-fluxing. Near the surface is found soft rich material which makes excellent furnace feed. Mining is all underground, and the deepest workings are about 6,000 feet below the surface. At this depth the ores are hard; they are apparently becoming more siliceous, and are expensive to mine. The mines are close to the excellent coking coals of the Warrior basin; and this, combined with the self-fluxing properties, has enabled the ores to compete with the higher-grade materials from Lake Superior and elsewhere. The Birmingham district has been the second largest producer of iron ore in the United States, after the Lake Superior region, producing annually between 6 and 11 million tons of crude ore in the 1950's; but the district has passed its peak of production, and output is expected to decrease gradually.

Brown Iron Ores.—The brown iron ores extend irregularly southward from Vermont along the Appalachian Mountains to Alabama. These ores consist mainly of limonite nodules in beds of shale and sandstone. They have been used extensively since colonial days, and the supply has been essentially exhausted. The ores were used both as direct furnace feed and as special lump ore. They are still so used when available. At Cartersville, Ga., brown iron ore is used as a source of ochre and umber.

Magnetite Deposits.—Beginning in 1937 several magnetite deposits in the Adirondack Mountains of New York State were developed. A few of the deposits, such as the Clifton, mine direct shipping ore. Most ores, however, contain magnetite grains distributed through gabbro or syenite, and they require concentration before they can be used in furnaces. Both open pit and underground mining methods are employed. Most of the ore contains 25 per cent or more of iron. It is crushed, concentrated magnetically or by other methods, and then nodulized in a kiln to form an excellent blast-furnace feed. New York State produces annually about 3 million tons of concentrates and direct shipping ores. The titaniferous magnetites of Lake Sanford, N.Y., are mined primarily for their titanium content. The residual magnetite, left after the titanium is removed, is sold to various steel plants, where small amounts are mixed with titanium-free ores. New Jersey also contributes between 1 and 1½ million tons of iron ore annually. This is obtained from high-grade magnetite deposits, nearly all mined by underground methods. In Pennsylvania the Cornwall magnetite mine has been operated since 1742, though it has passed its peak of production and its known reserves are limited. Pyrite in the ore at Cornwall contains a small percentage of cobalt and copper, which are recovered as by-products. A new iron ore body at the Grace mine, near Morgantown, Pa., was discovered by airborne magnetic methods of prospecting. Many other small magnetite deposits in the Eastern states have been mined, but at present are of little economic importance.

Western Ore Deposits.—Missouri.—Iron ore production in Missouri has come largely from deposits of hematite with minor magnetite in the Iron Mountain and Pilot Knob districts. Andesite porphyry of intrusive origin is associated with the ores at Iron Mountain. At Pilot Knob the ore replaces sedimentary beds and rests di-

CRUDE IRON ORE MINED IN THE UNITED STATES IN 1952 BY STATES AND VARIETIES
(Gross tons, excluding ore containing 5 per cent or more manganese)

State	Number of mines	Hematite	Brown ore	Magnetite	Total	Rank
Alabama	40	6,273,538	4,970,934	.....	11,244,472	3
Arkansas	1	.....	.....	..... 600	600	18
California	3	.....	.....	1,516,373	1,516,373	9
Georgia	13	 200	1,687,332	.....	1,687,332	7
Michigan	41	11,994,915	.....	.....	11,994,915	2
Minnesota	171	80,163,188	677,171	602,394	81,442,753	1
Missouri	5	580,648	177,700	.....	758,348	13
Nevada	12	169,332	.....	742,752	912,084	12
New Jersey	5	.....	.....	1,318,599	1,318,599	11
New Mexico	5	.....	.....	7,793	7,793	17
New York	6	.....	.....	7,267,202	7,267,202	4
Pennsylvania	1	.....	.....	1,596,191	1,596,191	8
Tennessee	3	47	46,197	.....	46,244	16
Texas	4	.....	2,417,864	.....	2,417,864	6
Utah	6	.....	.....	4,060,003	4,060,003	5
Wisconsin	2	1,495,109	.....	.....	1,495,109	10
Wyoming	1	484,945	.....	.....	484,945	14
Puerto Rico	1	.....	.....	138,613	138,613	15
Total	320	101,161,922	9,977,198	17,250,520	128,389,640	
Per cent of total		78.8	7.8	13.4	100.0	

Source: U.S. Bureau of Mines, *Minerals Yearbook 1952*, vol. 1, p. 506 (Washington 1955).

rectly upon porphyry-flow rocks. Nearly half a million tons of ore are produced annually from these districts. Between 150,000 and 200,000 tons of limonite are also obtained annually from filled-sink deposits in western and central Missouri and northeast Arkansas.

Texas.—The brown iron ores of east Texas have been extensively developed since World War II, between 2 and 4 million tons being produced annually. The ores, in unwashed condition, probably average 40 to 45 per cent iron. They consist of abundant nodules and layers of limonite in sand and clay layers, and are mined in open pits. The brown iron ores, smelted with coal from the McAlester district in Oklahoma, form the basis of a small iron and steel industry.

Wyoming.—The principal supply of iron ore for the smelter at Pueblo, Colo., comes from the Sunrise deposits at Hartville, Wyo. The ores are of a regionally metamorphosed banded iron formation similar to the taconites of the Lake Superior region. The best ore is hematite, which is concentrated in lenses of schist near the contact with underlying limestone. Both open and underground mines have been operated, and annual production has been about one-half million tons. Other hematite deposits of minor economic value are known near Seminole and Rawlins.

Colorado, New Mexico, and Arizona.—Numerous deposits of magnetite, hematite, and brown iron ores are widely distributed through these three states. The deposits are all small and without exception are of limited value as known. Several deposits, such as that at Fierro, N. Mex., have been productive in the past, but their ore is considered to be exhausted. Other deposits are too low in grade to permit profitable mining. Total production in recent years has been only a few thousand tons annually. Most of the ore mined in the past was shipped to Pueblo, Colo.

Nevada.—Small deposits of magnetite and hematite have been known in Nevada for many years, and some were mined in the past. It is only since the Korean War (1950–1953) that the properties have been extensively explored. The principal deposits are in the Buena Vista Hills, near Lovelock, but several others have been partly developed. The ore is high grade. Nearly the entire annual production of about 500,000 tons is exported to Japan.

Iron Springs District, Utah.—The Iron Springs district in southwestern Utah was first operated in 1874. It has furnished the principal ore supply to the blast furnaces and integrated steel works at Provo and Geneva, Utah. Lesser amounts of ore have been sent to Pueblo, Colo., and to Fontana, Calif., and a few shipments have been made to Japan. The ore is mainly magnetite with some hematite. It replaces limestone and is found in the limestone where it is in contact zones around three separate intrusive masses. The total reserves of the district are estimated to be in the order of one-half billion tons. The grade of the ore in the past is reported to have been between 55 and 60 per cent iron, though large amounts of it require beneficiation to bring it up to this grade. Annual production in the 1950's was between 4 and 5 million tons. With the increased demands for iron and steel in the Western states, the Iron Springs district is emerging as the principal ore supply available to Western industry. Other deposits of iron ore are known in Utah at Bully Hill and elsewhere, but they are of small size.

California.—About 50 deposits of iron ore are known in California. They are widely distributed throughout the state, and most of the deposits have been partly explored. Both magnetite and hematite deposits are common, and a few small deposits of brown iron ore are known. With a few exceptions the deposits are too small or too poor in quality to permit commercial exploitation. During World War II the Vulcan district in San Bernardino County contributed ore to the blast furnace at Fontana. In recent years ore for Fontana has come principally from Eagle Mountain in Riverside County. This deposit annually produces about 1½ million tons or more. Eagle Mountain is estimated to contain a known reserve of about 25 million tons, with a potential reserve of considerably larger amounts. Other localities, such as that of the Shasta deposit, have been worked for ship's ballast or for other special purpose ores. The deposits known are too small to be profitably operated, or they contain prohibitive amounts of deleterious elements, especially sulphur and phosphorus.

Northwestern States.—The iron ore deposits of the Northwestern states are small and annually yield only a few thousand tons of ore.

The Scappoose brown ores near Portland, Ore., have been explored but apparently have not proved to be economic. In northeastern Washington small amounts of brown iron ore are used in the cement industry. Other deposits are known in central and northern Washington but are not extensively mined. The Iron Mountain deposit and several other small bodies of hematite and magnetite in Idaho have been explored but have not been mined. In central Montana the Sheep Creek brown iron ores and the magnetite-hematite deposits of Wolf Creek are operated in a small way for use in the cement industry. Small amounts of iron ore are also mined in South Dakota, principally from the soft iron ores in the Black Hills. For bibliography, see 9. *World Supplies* (Bibliography).

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9. WORLD SUPPLIES.—The rapidly increasing demand throughout the world for iron and steel products has given great impetus to the search for and development of new iron ore bodies. Districts remote from smelting centers are being explored and mined; new and costly methods of beneficiating low-grade materials are being developed and installed. The iron ore industry is keeping pace with the increased demand for steel, though the capital expenditures involved are tremendous. Since the amount of iron ore mined near the large steelmaking centers is no longer adequate to meet the increasing demand, despite generally increased production, other sources of supply must be developed. The trend in the United States, and to only a slightly lesser extent in Europe, is toward increasing dependence upon foreign, and in large part remote, supplies. This trend is expected to continue. Among the larger deposits developed since World War II are the Ungava Bay region in Labrador and Quebec, Cerro Bolivar in Venezuela, Romeral in Chile, Marcona in Peru, and the Bomi Hills in Liberia. In addition to iron ores, approximately 6 million tons of highgrade hypocrud iron sinter are used annually to supplement the available ore in the United States alone. Scrap iron constitutes another invaluable source of raw material for the furnaces.

North and Central America.—In North America, outside of the United States, large amounts of ore have been produced from the high-phosphorus oölitic hematite in the Wabana district of Newfoundland. This ore, because of its high phosphorus content (up to 2 per cent phosphorus), is shipped to Europe, where it is reduced by the Thomas process. The deposits contain an estimated reserve of about 3 billion tons with a grade of between 48 and 57 per cent iron. The Michipicoten range, on the Canadian side of Lake Superior, has maintained a small but steady production for years. Since 1944-1945, exploitation of the Steep Rock Lake deposits in the Atikokan range in southern Ontario has expanded continuously after the successful diversion of a river and the draining of Steep Rock Lake. These deposits are thought to contain about 600 million tons of ore. Hematite deposits in the Ungava Bay region of Labrador and Quebec have been developed and have attained an annual production of about 10 million tons. These deposits are estimated to contain a reserve of about 2 billion tons and are expected eventually to produce 25 million tons yearly. A standard-gauge railroad now connects the mines

with new port facilities on the St. Lawrence River, and the ore will be readily available to the Great Lakes steel centers upon completion of the St. Lawrence Seaway. The Marmora and other small properties in Ontario and in nearby Quebec contribute considerable production annually. In western Canada deposits on Vancouver Island, Texada Island, and elsewhere in British Columbia produce small quantities of ore for the export trade to Japan.

Several magnetite-hematite deposits are known in Mexico, but few of them have been developed. Probably the best known are at Cerro de Mercado, north of Durango, which yield sufficient ore to maintain a small smelting industry. Other magnetite-hematite deposits, such as those of El Vulcan, Las Truchas, and Aguililla, are known in the State of Michoacán in western Mexico and elsewhere in Mexico and Central America, especially in Nicaragua and Honduras. The laterite deposits of Cuba, especially those along the northeastern part of the island, constitute a tremendous reserve of potential low-grade ore. Efforts to produce uniform steel products from these laterites have so far been uneconomic, largely because of variable amounts of nickel, chromium, and water in the ore.

South America.—Among the largest and richest iron ore reserves in the Western Hemisphere are the deposits near the city of Belo Horizonte in the State of Minas Gerais, Brazil. These deposits are about 325 miles inland from the ports of Vitória and Aracruz (formerly Santa Cruz), and about the same distance north of Rio de Janeiro. Estimates of available reserves range up to 15 billion tons, containing about 35 per cent iron. Much smaller tonnages are higher in grade. The well-known deposits at Itabira export between 2 and 3 million tons of high-grade lump ore annually to the United States and to Europe. Ore from the deposits at Casa de Pedra is transported by rail southward. It furnishes most of the ore for the Brazilian iron and steel works at Volta Redonda. Many other small properties contribute to the export ores, which average between 55 and 69 per cent of iron and are low in phosphorus and sulphur. Other large deposits are in western Brazil near Corumbá on the Paraná River in the State of Mato Grosso. This ore is remote from any steel-making center, and is undeveloped except for small pits that furnish ore to local charcoal furnaces.

Within recent years Venezuela has become one of the principal exporting countries for iron ore in the Western Hemisphere. The largest deposit is at Cerro Bolivar, about 91 miles south of the Orinoco River on the west bank of the Caroni River. This deposit is estimated to contain at least 400 million tons of ore, and production facilities are designed to handle more than 10 million tons annually. The deposit at El Pao has published reserves of 70 million tons and annually exports between 2 and 3 million tons to the United States. The grade of Venezuelan ore averages about 60 per cent iron, and the total estimated reserves of the country are about 2 billion tons. Venezuela is an important supplier of iron ore to the United States, and it is expected to maintain and to improve its position.

Iron ores are known at many places along the western coast of South America. In Peru the deposits at Marcona contain large tonnages of ore. These deposits, developed in 1953, are expected to assume increasing importance.

In Chile the famous deposit at El Tofo has been exhausted, but new deposits at Romeral near Coquimbo are now in production. The large deposit at Algarrobo in the desert of northern Chile is as yet undeveloped. Chilean deposits supply ore for the steel mills at Huachipato in central Chile and also export a million or more tons annually to the United States. In addition to the high-grade deposits in South America, large tonnages of potentially valuable laterites exist at many places in the tropics.

Europe.—Europe contains several large deposits of excellent iron ore, as well as many smaller deposits and others of marginal grade and character. Because of the wide distribution of iron and steel works and the excellent system of transportation in Europe, ores are mined and treated that would be uneconomic in other parts of the world. Deposits, well known in the past, such as the famous districts of Bilbao in Spain, Eisenerz in Styria (Austria), the Lahn-Dill and Sieg river valleys in Germany, and the Banat district in Rumania, are long since past their peaks of production, though small amounts of ore continue to be mined. Many of the European ores are high in phosphorus and are smelted in the Thomas basic open-hearth furnaces. In this process the phosphorus is recovered from the slag and used in fertilizers.

Probably the largest single source of iron ore in Europe is the minette ore of Luxembourg and Lorraine. These deposits have long been the backbone of the European iron and steel industry. They are estimated to contain a reserve of as much as 15 billion tons, which is low grade, containing an average of between 30 and 35 per cent of iron. The ore is also high in phosphorus, 1.6 to 1.8 per cent. Where iron content decreases, the lime content generally increases. Sufficient lime is present to make much of the ore self-fluxing, and little or no additional limestone must be added during smelting. France also produces small amounts of ore in Brittany and in Normandy.

In Germany the Watenstedt-Salzgitter-Peine deposits are said to contain a reserve estimated at between 1 and 2 billion tons. The ore averages only 29 to 33 per cent iron, and is high in both phosphorus and silica. Several smaller deposits are also exploited in Germany.

The highest-grade ores in Europe are found in northern Sweden, especially at Kiruna and Gällivare. The reserves at Kiruna are estimated at 1.5 billion tons and at Gällivare at about 200 million tons. Most of the ore is exported to the Ruhr and to Great Britain, although it is used throughout Europe. Another productive district in Sweden is that at Grangesberg in the south central part of the country. Deposits in northern Norway at Sydvaranger and Dunderland have both produced ore and have large reserves; but the long haul to the steelmaking centers, the low grade of the ore (between 36 and 39 per cent iron), and the low phosphorus content have discouraged extensive development.

In the British Isles, the low-grade (25 to 35 per cent iron) deposits of Yorkshire and Northamptonshire furnish a considerable part of the ore available for domestic use. The reserves of this ore are estimated at about 3 billion tons. Other large reserves of low-grade carbonate ores are known in west England and in Wales; the grade is less than 30 per cent iron. The British iron and steel industry has difficulty competing

with higher-grade foreign ores and with the better coal resources of the Continent. The industry is therefore becoming increasingly dependent upon imports.

The Soviet Union contains many large iron ore deposits and has been energetically expanding their production. Probably the best-known of the deposits in the Ural Mountains is that of Magnitnaya near Magnitogorsk. The ores contain an average of between 55 and 65 per cent iron and are low in phosphorus; the reserves are estimated at more than 400 million tons. In the Crimean region on the north shore of the Black Sea, the Kerch Peninsula has long been a producer of low-grade iron ores. The ore mineral is mainly limonite which contains between 38 and 43 per cent iron. The reserves are estimated to be as much as 2 billion tons. A third deposit of similar size and grade is at Krivoi Rog, northeast of Kerch. Other smaller deposits are widely distributed through European Russia.

Deposits of small size or of inferior grades are irregularly worked in Czechoslovakia, Italy, Greece, Albania, Bulgaria, Poland, Switzerland, and Spain.

Asia.—Asia contains large iron ore deposits, although many of them are far from smelters and are relatively undeveloped. The total production of ore is small but is increasing as the local steel-producing centers are expanded. India, with a conservatively estimated reserve of over 12 billion tons of good-grade ore, has some of the largest deposits in the world, mainly in the states of Bihar and Orissa, and in the Bastar District of Madhya Pradesh. Lack of transportation facilities and government-imposed economic restrictions have so far prevented extensive development. The ores are used domestically at the Tatanagar steel works, and very little goes into the export trade. Most of the ores are banded hematites similar to the taconites of the Lake Superior region.

China and Manchuria also contain several large deposits of iron ore. During the Japanese occupation of China, the deposits worked included those on Hainan Island and several magnetite ore bodies along the Yangtze River near Nanking. Low-grade oolitic ores are also mined in the Suanlung district northwest of Peking. The banded ores of Liaoning Province, Manchuria, support a small steel industry. The grade of these ores is only between 30 and 35 per cent iron, but they are said to be very extensive.

Japan has the most completely integrated iron and steel industry in Asia, but is largely dependent upon imported ores. Small magnetite deposits at Kamaishi on Honshu Island are approaching exhaustion, though they are still the largest domestic suppliers of ore. Scattered low-grade deposits of limonite in Hokkaido also yield small tonnages. Limited amounts of titaniferous iron beach sands are used, and residues from the pyrite that is burned in sulphuric acid plants furnish about 1 million tons of sinter annually.

A deposit in the Philippine Islands in the vicinity of Paracale and Jose Pangasinan, on the island of Luzon, annually sends a million or more tons of high-grade ore to Japan. Other magnetite deposits are known in the Philippine Islands but have been little developed. Philippine ore is almost all exported. In the extreme northeast of Mindanao, the Surigao laterite deposits have attracted considerable attention but so far have been uneconomic to mine.

Small deposits of iron ore are worked in Korea, Indochina, Borneo, and the Federation of Malaya. One of the best-known deposits is at Dungan in Malaya, from which about 2 million tons of ore are shipped annually to Japan; this deposit contains an estimated reserve of about 60 million tons. Small deposits of iron ore are known in southern and western Siberia, although few of them are described in available literature, and the reserves and grade are unknown. Probably the largest Siberian deposits are those on the northern slopes of the Altai Mountains near Ilimsk and Abakan. Elsewhere in Asia small deposits in Afghanistan, Turkey, and Arabia, are not at present of great economic value.

WORLD PRODUCTION OF IRON ORE DURING 1950
BY IMPORTANT COUNTRIES
(Thousands of metric tons)

Country	Production	Per cent of total	Principal mining method
Algeria	2,573	1.05	Open pit
Australia	2,403	.98	Open pit
Austria	1,859	.76	Open pit
Belgium	46	.02	Underground
Brazil	1,900	.78	Open pit
Canada	3,309	1.35	Open pit and underground
Chile	2,976	1.21	Open pit
China	Not available		Open pit
Czechoslovakia	1,600	.65	Underground
France	30,203	12.33	Underground
Germany, East	328	.13	Underground and open pit
Germany, West	10,882	4.44	Underground and open pit
Hungary	368	.15	Open pit
India	3,000	1.22	Open pit
Italy	442	.18	Open pit
Japan	910	.37	Open pit
Luxembourg	3,845	1.57	Underground
Mexico	420	.17	Open pit and underground
Morocco	1,179	.48	Open pit
Poland	790	.32	Open pit and underground
Rumania	395	.16	Underground
Sierra Leone	1,185	.48	Open pit
Spain	2,079	.85	Open pit and underground
Sweden	13,927	5.68	Open pit and underground
Tunisia	758	.31	Open pit
Union of South Africa	1,189	.49	Open pit
United Kingdom	13,145	5.37	Open pit and underground
United States	99,740	40.71	Open pit and underground
USSR	Not available		Open pit and underground
Yugoslavia	800	.33	Open pit
World total (estimate)	245,000		

Source: U.S. Bureau of Mines, *Mineral Facts and Problems*, p. 395 (Washington 1956).

Oceania.—Iron ores are mined in the Middle-back Range, South Australia, and to a much less extent in New South Wales, Queensland, and Tasmania. Deposits of banded ores are known in the Yampi Sound area of Western Australia, but little development work has been done on them. New Zealand has extensive reserves of black sands, much of which is high in titanium and difficult to use in the iron and steel industry. Several small magnetite deposits are known in Indonesia but are of little economic value. Large amounts of laterite in New Caledonia, south-eastern Borneo, and the central Celebes, are not utilized.

Africa.—As Europe and the United States become more and more dependent upon imported iron ores, additional attention is being paid to Africa, especially to the areas most accessible to the coast in the northern and western parts of the

continent. Reserves of more than 500 million tons are estimated to be present in North Africa, largely in Algeria and to a lesser extent in Morocco and Tunisia. The ores range in grade from 45 to 65 per cent iron, and are exported, principally to Germany and England. About 2 million tons of ore are exported annually from the Bomi Hills, Liberia, to the United States. This district contains an estimated reserve of about 30 million tons which average between 60 and 68 per cent iron. Countries that are said to contain deposits of possible economic value include Mauritania, French Guinea, Sierra Leone (Tonkolili District), Nigeria, and Gabon. These deposits are remote from steelmaking centers and will be expensive to explore, to mine, and to transport. Large tonnages of manganiferous iron ores are reported in the Postmasburg district of western South Africa. This district has been best known for its production of manganese, but about 1 billion tons of high-grade iron ores are said to be present. Ores from the Rustenburg district in southwestern Transvaal have been sufficient to maintain a small iron and steel industry at Pretoria. Other deposits in South West Africa, Transvaal, and Natal are known, but so far have proven to be of slight economic value. Large bodies of titaniferous iron ores in the Njombe district of Tanganyika have also remained undeveloped. Other small iron ore bodies exist in the Belgian Congo and in other more remote parts of Africa. Large regions underlain by laterites are also recognized throughout much of tropical Africa.

Total World Reserves.—The total iron ore reserves of the world in 1957 were estimated at about 60 billion tons. This includes ores of all grades but is limited to materials that are economic at the present time. In addition, about 150 billion tons of potential and marginal ores are estimated to exist.

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10. MINING AND HANDLING OF IRON ORE.—The geographical locations where the world's iron ore mines have been developed are largely controlled by the cost of assembling raw materials for the steel industry. Because the value of iron ore and coking coal is low in relation to weight, the cost of transportation restricts the distance such materials can be moved economically. As a rule, it is cheaper to move ore to fuel than fuel to ore; hence low-priced coking coal has been the dominant factor in the location of iron and steel industries. The cost of iron delivered at the consuming center and the quality of the ore determine its value, and the grades marketed vary greatly for different localities.

IRON



Courtesy (top) American Iron and Steel Institute; (bottom) Oliver Iron Mining Company

Top: Traveling ore bridge, with blast furnace in background. Iron ore in stockpile under ore bridge is delivered to blast furnace by ore cars. Bottom: Ore classification yard near a Lake Superior port, where ore cars are regrouped to make uniform cargo shipments of various specified grades.

IRON



Ore boat riding low in water and carrying ~~inside~~ ^{about} 18,000 gross tons of iron ore, being unloaded by Hulett unloaders at a Lake Erie port.

Schmidt Studios

PRODUCING COUNTRIES

The foregoing table lists the production of iron ore by countries producing in excess 200,000 metric tons during 1937, the year of greatest iron ore production prior to World War II:

During 1937, eighteen countries produced in excess of 1,000,000 gross tons each of iron ore, but only seven of these exceeded 5,000,000 tons. The relative importance of these seven producers and their relation to principal importing and exporting countries is portrayed on the preceding chart.

The extensive iron ore exports of France and Sweden move to Europe's steel plants located close to coal. The movement of the iron ores of French Lorraine to the coal fields of the Ruhr and Saar valleys as well as to Belgium and Luxembourg is paralleled in America by the shipments of Lake Superior district iron ores to the coal districts of Pennsylvania, Ohio, Indiana and Illinois. In the latter case there are no international barriers to impede this commerce, and American enterprise has developed the greatest steel producing and manufacturing region in the world.

Grades of Ore Shipped in the United States. The chemical and physical properties of iron ores vary greatly. The presence or absence of desirable elements or objectionable impurities and the physical make-up of ores, as well as their iron content, determine their value at consuming centers.

Phosphorus, sulphur, and silica are the chief impurities found in American ores. When phosphorus is less than .045 per cent, the ores are classed as Bessemer grade. The quantity of permissible phosphorus and silica varies with furnace practices, but usually silica in excess of 8 per cent produces too much slag and is undesirable. Lime, magnesia and, at times, alumina are beneficial as fluxes. Manganese is especially desirable, and if it exceeds 5 per cent, the ore is called manganiferous iron ore and is not classed as iron ore. Manganiferous iron ores come largely from the Lake Superior district,

ing samples at 212° F. to eliminate moisture. Lake Superior ore shipments average more than 10 per cent moisture.

In the Lake Superior district, where freight to market is a major item of cost, the average grade of ore shipped is about 51.5 per cent iron; material containing up to 35 per cent iron is not ore and is called iron formation. Some day much of this material will be concentrated into a high-grade marketable product.

In contrast, in the southeastern district tributary to Birmingham, Alabama, where iron, coal, and limestone occur close together, the ores used, which contain lime and are partly self-fluxing, average only about 36 per cent iron.

Northeastern district shipments from New York, New Jersey, and Pennsylvania average more than 61 per cent iron. Most of this material is a magnetic concentrate or sintered concentrate, produced from low-grade magnetic material containing from 25 per cent to 50 per cent iron as mined. Concentration of such material is necessary in order to yield a high-grade product marketable at consuming centers in competition with Lake Superior or imported ores.

The grades of Western ores as shipped range from about 51 per cent iron for Utah ores to about 55 per cent for California ores.

Lake Superior District.—The Lake Superior district is the greatest iron mining region in the world. It includes the mining localities or ranges tributary to Lake Superior navigation in Minnesota, Wisconsin, and Michigan, and also in Ontario, Canada. These ranges have been developed as follows:

Most of the ore produced in the Lake Superior district moves nearly a thousand miles to market. This is possible because of large-scale, economical operations and cheap water transportation. The average rail haul of ore from mines to Upper Lake ports is about 75 miles. The lake haul is about 750 miles with an additional rail distance of about 150 miles to inland furnaces.

DEVELOPMENT OF RANGES, LAKE SUPERIOR DISTRICT

(Gross Tons)

Range Name	Location	First Shipped	1942 Shipments	Per cent of Total	Total Shipments Including 1944	Per cent of Total
Marquette	Michigan	1854	6,540,731	7.00	230,124,450	10.46
Menominee	Michigan	1872	4,930,434	5.27	208,088,388	9.46
Gogebic	Michigan-Wisconsin	1884	6,237,894	6.67	245,187,669	11.14
Vermilion	Minnesota	1884	1,924,877	2.06	75,770,532	3.44
Mesabi	Minnesota	1892	70,280,087	75.17	1,378,117,290	62.65
Michipicoten	Ontario, Canada	1900	486,666	.52	5,885,746	.27
Moose Mountain	Ontario, Canada	1908	—	—	404,874	.02
Cuyuna	Minnesota	1911	3,035,532	3.25	52,563,951	2.40
Atikokan	Ontario, Canada	1944	—	—	16,552	.00
All Others	Wisconsin-Minnesota		59,171	.06	3,502,543	.16
Total United States Ranges			93,008,726	99.48	2,193,354,823	99.71
Total Canadian Ranges			486,666	.52	6,307,172	.29
Grand Total			93,495,392	100.00	2,199,661,995	100.00

where the Cuyuna range in Minnesota is the principal producer.

Generally, ores high in iron content are preferred, and lower-grade ores in most districts are concentrated to improve their quality. Local conditions determine the grades used.

In marketing iron ores, analyses of iron refer to the quantity of metallic iron in the ores as shipped and not to dry analyses made after dry-

The shipping season is geared to Great Lakes navigation and lasts about seven months each year, depending on weather conditions. Underground mines operate on a 12-month basis and stockpile their winter production. In the open pits stripping operations continue during the freeze-up period, thereby spreading employment and utilizing equipment.

Mining.—There are a wide variety of iron min-

ing methods in use, depending on the shape, size, and location of ore bodies and on the character of the ore and the surrounding rocks. Some ore bodies are close to the surface as on the Mesabi range, and others extend to considerable depths which, on the Gogebic range, exceed 3,000 feet below the surface. Some ores are low grade and require beneficiation before shipment, and others consist of nearly pure iron oxides containing 70 per cent iron.

The mining methods used are those giving greatest safety with maximum efficiency. Where ore bodies dip steeply with small surface exposure, or extend to great depths, underground mining methods are necessary. If the ore is close to the surface with relatively large areas of outcrop, open-pit methods are employed.

In underground mines, top slicing and caving methods are used extensively, especially where the ores are soft. In hard ores, open stope methods are employed, as on the Marquette range. At other places, cut and fill and variations of open stope methods are used.

Mechanization of underground operations is well developed, and innovations are continually being tried out. Because of the great weight or high specific gravity of iron ores in comparison to equivalent volumes of other ores as mined, the equipment used in iron mines is usually of sturdier construction than is generally employed in other mining operations. Machines drill the ore and, after it is blasted, it is moved with mechanical scrapers or loaders to reach shaker conveyors, conveyor belts or electric rail haulage, or a combination of these methods of transportation, to shafts where it is hoisted to the surface and loaded into railway cars or placed on stockpiles.

Open pit mining has its greatest development on the Mesabi range and is described under that heading.

Mesabi Range.—During 1942, 70,280,087 gross tons of iron ore were shipped from the Mesabi range. Production came from 78 open pits and 9 underground mines. This array of operations is condensed into a length of 80 miles and offers an opportunity to view, almost side by side, a wide range in the methods of handling ore.

The largest ore bodies in the Lake Superior district occur on the Mesabi range in iron formation which has a gentle dip, and most of the ore is within 600 feet of the surface. The ore bodies consist of iron oxides formed by oxidation of various iron minerals and by solution and removal of silica from the iron formation, leaving a characteristic, soft, porous ore easy to drill and blast. Previous to mining operations, most of the ore was covered with glacial clays, sands, and gravels that ranged from a few feet to 250 feet in thickness. Part of the ore lies beneath a capping of iron formation overlaid by drift. Where the cost of removing overburden is not excessive, an open pit method is used. The quantity of stripping removed to uncover an ore body during development and operation of an open pit may exceed the tonnage of ore produced. The material stripped consists of glacial drift, iron formation, and lean ores, which are segregated into separate dumps to facilitate possible future utilization. The dumps which have accumulated during the development and shipment of more than a billion tons of open pit ore from the Mesabi range form prominent landmarks near major operations.

Nearly all of the ore in the open pits requires drilling and blasting before it can be handled by power shovels. Standard mobile churn drilling rigs are used for this purpose. In other regions where the ore is harder, closer drilling is required to break the ore, but otherwise the mining methods are essentially the same.

In the open pits the choice of equipment (locomotive haulage, truck or conveyor belt, or a combination of these) and power (steam, electricity, or Diesel) varies with the operation.

Starting in the middle 1930's, locomotive haulage has given way to trucking and belt conveyor installations, and steam locomotives used in the larger pits are being replaced with Diesel electric units, first introduced during 1940.

Power shovels, which previous to 1922 used steam power and operated from railway tracks, have been replaced with smaller, more mobile, and quicker acting electric or Diesel shovels mounted on caterpillar treads.

The evolution in operating methods is illustrated by the changes which have occurred at the Albany mine near Hibbing, Minn. This property is one-half mile long and one-quarter mile wide and its ore body extends onto adjacent property having separate ownership where it is mined by different interests. The Albany mine was opened up in 1902 as a milling pit. The overburden of glacial drift was stripped by steam shovel. An inclined shaft was sunk to the bottom of the ore body from which a system of development drifts (tunnels) extended underneath the ore to be mined. Vertical openings called raises extended from these drifts to surface through the ore. The surface ore was "milled" or shovelled into these raises and drawn off into cars which were hauled by mules to the inclined shaft, and the ore hoisted to the surface. In 1913 the limits of the pit were extended and a narrow gauge railway system was installed. This was changed to a standard gauge railway system in 1924, and the ore was then hauled to the surface by steam locomotives. By 1939, six switchbacks were required to reach the bottom of the pit and much ore was tied up in track benches. A truck haulage system was substituted during 1939, thereby releasing additional ore for mining and obtaining operating economies.

Ore from the property west of the Albany mine, which is part of the same ore body and open pit is handled by trucks which load onto a conveyor belt, carrying the ore from the pit to railway ore cars on the surface.

There is considerable variation in the arrangement of conveyor belts in different pits. At one mine the belt extends from a railway loading pocket on the surface through an underground incline to beneath the ore body. Raises extend from underground feeder belts to the pit bottom with ore delivered to the raises by trucks. At other properties, conveyor belts extend in part through pit walls or are built entirely in the open from pit bottom to railway pockets on the surface.

Several large open pits developed to supply wartime ore requirements use standard railway equipment, but in general the smaller operations use truck or conveyor belt haulage.

The most spectacular mining operation on the Mesabi range is the Hull-Rust-Mahoning open pit at Hibbing. The ore body, parts of which are separately owned and operated, covers an area

of 1,200 acres and is more than 3 miles long with a width ranging up to one-half mile and a depth of about 450 feet. Waste material removed between 1895 and 1945 exceeded 270,000,000 gross tons with ore shipments totaling 383,000,000 gross tons. During the war period, from 1941 through 1945 inclusive, more than 110,000,000 tons of ore were shipped, and each year's shipments exceeded 20,000,000 tons, or, more than 20 per cent of all the iron ore mined from the United States during this period. Haulage of ore mined in the main pit is mostly by rail and during 1944, 40 locomotives were used, of which 13 were steam and 27 were Diesel-electric. Twenty-six power shovels operated, 20 of which were electric and 6 were Diesel, varying in size from 1.5-8 cubic yard dipper capacity. Parts of the ore body have been bottomed, and trucking, called "scramming," was used to deliver ore from power shovels and clean-up jobs to railway cars in the pit. Haulage from several subordinate parts of the eastern end of the main pit was by truck, conveyor belt, and, in one case, a shaft which had ore delivered to it from a conveyor belt serviced by trucks on the pit floor.

When rail haulage is used in the open pits, the ore loaded may go directly into railway ore cars for delivery to shipping ports, or it may require crushing or concentrating by milling methods before shipment. Direct shipping ore is sampled in 5- or 10-car lots as it leaves the mines. Ores requiring crushing, screening, or concentrating are sampled before and after treatment.

Crushing and Screening: Often crushing and screening, or screening alone, is necessary to improve the physical structure of ores as well as to effect some concentration. Lumpy, hard, siliceous material is locally found with good ore, and this lean material can be removed from screens while softer, richer ore breaks to finer sizes and passes through the screens. Products from crushing and screening plants are not classified as concentrates.

Concentration.—Large tonnages of iron-rich material in the iron formation contain too much silica to be used directly in the blast furnace, and such material requires concentration to a purer form. Some lean ores, especially on the western Mesabi range, contain fine, unleached silica grains which can be washed away with a stream of water. These ores are called "wash ores." In other places the silica is in coarser consolidated pieces attached to iron oxides and requires crushing before removal by gravity or other concentration processes. Certain portions of iron formation contain large quantities of finely disseminated and banded magnetite which can be concentrated magnetically after fine grinding. Other portions of iron formation with iron in the ferric state can be roasted to make the iron magnetic, after which magnetic concentration is possible. Various methods of concentration are necessary, depending on the nature of the material to be beneficiated.

The wash ores were the first to be concentrated on the Mesabi range, and the first shipment of concentrates, amounting to 9,816 gross tons, was made in 1907. Since then, jig, high-density or sink-and-float, and magnetic concentrates have been processed. From 1907 until 1945 about 208,000,000 long tons of concentrates were shipped from Minnesota. This material,

by displacing direct shipping ores of richer grade, has conserved the latter for future use. Since 1907 the ratio of concentrates to ore shipments has increased from .03 per cent to more than 22 per cent, and the ratio of total concentrates to total shipments for the period 1907 to 1945 is about 14 per cent. During the war years of 1942-1945, nearly 45 beneficiation plants on the Mesabi range and 5 on the Cuyuna range were in operation, and each year these plants shipped a total of more than 15,000,000 tons of concentrates. The rated capacity of these plants is much larger than this.

An accompanying photograph shows a concentrating plant on the western Mesabi range. This plant, completed in 1910, had shipped more than 55,000,000 tons of concentrates by 1945, and the flow sheet was improved many times during this period.

Metallurgical research by mining companies and other organizations was greatly expanded during and after World War II in order to improve the structure and grade of iron ores being used, as well as to make commercial ore products from lower-grade iron formation. Enormous quantities of such material, containing 30 per cent or more iron, are present in the Lake Superior district. The low value of iron ore, however, requires extremely low-cost concentration processes. The price received for the iron contained in iron ore after it is transported down the Great Lakes is slightly less than one-half cent per pound, of which transportation costs amount to about one-quarter cent per pound of contained iron. There is not much margin for concentration and other expenses, and economic handling on a large scale is required for all operations from mine to furnace.

At the consuming centers, Lake Superior concentrates are in direct competition with North-eastern district concentrates and imported ores. Also the pig iron processed from iron ores in the blast furnaces is in competition with purchased scrap iron for making steel. The importance of scrap iron and the fact that more than 45 per cent of all American steel is now made from scrap were emphasized by the scrap drives during World War II. The increasing use of scrap iron by displacing iron ores is a very important factor in the iron ore trade.

Grading of Ore.—Iron ore shipments from the Lake Superior district are carefully graded to meet strict specifications of the iron trade, and each cargo shipment conforms closely to some guaranteed content of iron, phosphorus, silica, and manganese.

A typical shipment of Mesabi range ore is handled as follows: loaded railway cars from the mine crushing plant or concentrator are sampled in 5- or 10-car lots before being delivered to railway company assembly yards near the mines; there they are grouped into trains of various lengths and hauled by heavy steam locomotives to classification yards near the docks. En route from mine to classification yards the ore cars pass over track scales which record automatically the gross weight of each car. While the ore is in transit, the previously taken samples are analyzed for iron, phosphorus, silica, manganese, and moisture; the ore grader, using these results, determines how the ores should be mixed to yield a cargo of specified grade. Instructions are relayed to the yardmaster at the classifying yards, and, upon arrival

of the ore trains, the cars are regrouped according to the desired block or group of dock pockets for a designated boat. Ore for a single cargo may be sorted from different trains and come from different mines. Additional mixing is sometimes obtained by dumping ore from several cars into the same ore pocket, and such ores are thoroughly mixed as they flow into the boats.

In some districts, domestic and foreign, where ore shipments vary in grade as received at the furnace, bedding plants similar to those used in the copper industry are employed to provide a uniform furnace feed. Blending is controlled by stocking bridges with a belt conveyer feed and a traveling reversing discharge that builds stockpiles in long piles composed of many successive layers of ore. A reclaiming machine spans each stockpile and takes cross-section cuts, which include a portion of each layer of the stockpile. Conveyer belts then carry the ore from bedding plants to furnaces.

Transportation.—Railway equipment, docks, and ore boats in the Lake Superior district are specially designed for large-scale, efficient, rapid ore handling. All railway ore cars are of the steel hopper type, 24 feet long, and dump into alternate pockets on high-level, pocket-type ore loading docks, where 12-foot pockets correspond with 12- or 24-foot spacing of boat hatches. The capacity of ore cars is 50 or 75 long tons; dock pockets hold 250 to 400 tons each; and ore boats carry loads ranging up to 18,000 tons. The central portion of these vessels is cargo space, with crew quarters, engines, and fuel grouped together in bow and stern.

At upper lake ports ore from the ore docks flows by gravity from ore pockets through long steel spouts into the holds of the boats, and the loading time of a boat is about 4 hours. The record loading time for a cargo of 12,817 tons is 16.5 minutes. Unloading at lower lake ports is done rapidly by means of huge clamshell buckets of 9-ton capacity or by means of giant electrically driven Hulett unloaders with maximum bucket capacities of 20 tons. There are about 300 ore boats in service, with a carrying capacity per trip of nearly 3,000,000 long tons. An ore boat can make a round trip in about a week unless coal is carried on the return voyage, in which event the round trip may take as long as 10 days. Ore from lower lake ports goes either directly to consuming furnaces or to stockpiles at the docks.

Ranges in Ontario, Canada.—The Atikokan and Michipicoten ranges in Ontario, Canada, occur within the Lake Superior district, and their production is shipped via Lake Superior. Much of this ore is consigned to furnaces in the United States.

The first ore shipment from the Atikokan range was made during 1944 after a large river was diverted and a lake pumped out to uncover ore which lay beneath 50 to 150 feet of water and considerable mud, clay, and gravel. This development, now an open pit power shovel and trucking operation, will eventually require underground mining methods. The ore is shipped by rail about 140 miles eastward to Port Arthur on Lake Superior, where a high-level, pocket-type dock was completed during 1945.

The Michipicoten ore is largely an iron carbonate. After mining, which includes open pit as well as underground operations, the ore is crushed and roasted to drive off carbon dioxide.

This calcined product is then sintered and shipped by rail to a Michipicoten harbor. Port facilities include a 12,000-ton loading bin with a conveyer belt system for loading ore boats.

Southeastern District.—Iron mining in the Southeastern district is centered around Birmingham, Ala., where the advantage of the coexistence of iron ore, coal, and limestone offsets the lower quality of the ores used.

The ores found near Birmingham, called Clinton ores, are red hematites of bedded sedimentary origin. They dip about 20° from the horizontal, but flatten to around 10° in depth. Mining, which started in open pits in soft leached ore, is now confined mainly to underground operations in hard ore. Inclined shafts called slopes follow down just beneath the ore seams, and in some places these haulage ways extend for a mile or more down the dip. Levels extend out from the slopes, and the ore is mined in open stopes, excavated working places where pillars are left to support the roof or hanging wall. After drilling and blasting, the ore is scraped with mechanical loaders into ore cars and transported by rail to loading pockets at the main slopes. The ore flows into skip cars and, after being hoisted to the surface, is crushed, screened, and sized before being shipped to nearby furnaces. The ores as mined average 35 to 37 per cent iron, with 0.2 to 0.4 per cent phosphorus, and in large part contain enough lime to be self-fluxing.

Some Clinton ore is mined on a smaller scale in northeastern Alabama, Georgia, Tennessee, and Virginia.

In addition, brown ores, consisting principally of limonite associated with clay, sand, and gravel, are mined in open pits. These ores require washing and screening before shipment. The largest production of this type of ore comes from the Russellville area of northwestern Alabama, with additional shipments from Kentucky and Tennessee.

Northeastern District.—The Northeastern district includes producing mines in New York, New Jersey, and Pennsylvania. The ore consists of magnetite in various amounts associated with ancient banded rocks. In several places the iron occurs as nonmagnetic hematite or martite as well as magnetite. Impurities include phosphorus, sulphur, titanium, and silica. Some of the ore is rich enough for direct shipment as premium lump ore, but most of it, as mined, ranges from 25 to about 50 per cent iron and requires concentration. Concentration plants in service at the end of World War II had a rated annual production capacity in excess of 5,000,000 long tons of concentrate which should average better than 60 per cent iron.

New York.—Mining operations are now centered in the Adirondack area of northeastern New York, where the entire iron mining practice has been renovated and expanded since 1937.

Underground mines are located near Port Henry and Lyon Mountain, where the magnetite ore horizon dips at variable angles. Inclined shafts extend downward, usually just beneath the ore. Where the ore horizon is steep enough for the ore to run by gravity, shrinkage stopes (an overhead mining method in which sufficient broken ore is left in the stope to provide wall support and to act as a working platform) are used. Where the ore lies flatter, the ore is mined in open stopes, and mechanical scrapers

IRON



Courtesy American Iron and Steel Institute

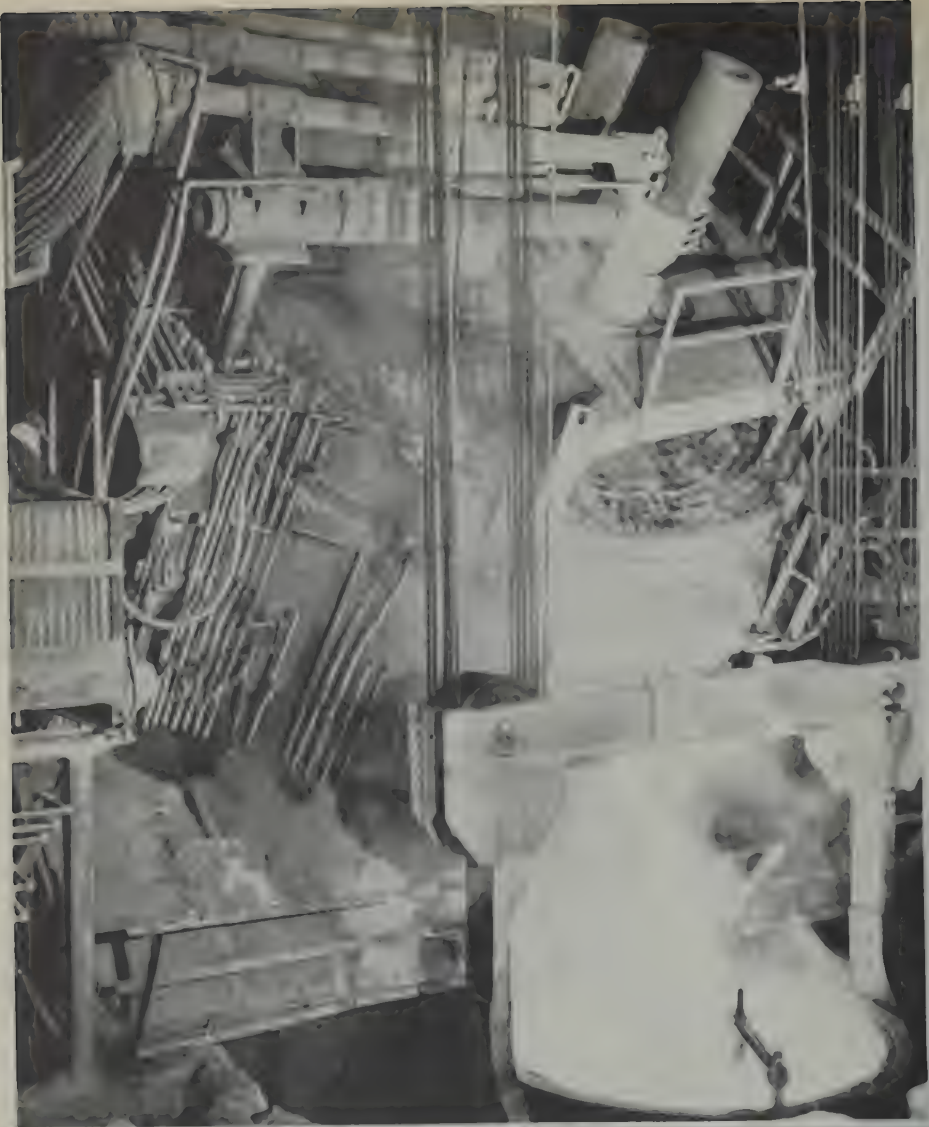
A 70-ton basic electric arc furnace in operation.



Courtesy Oliver Iron Mining Company

Looking west into the Hull-Rust-Mahoning open pit iron mine, Hibbing, Mesabi Range, Minnesota. Essentially a haulage operation, this mine has at times produced in excess of 20,000,000 gross tons of ore annually.

IRON



Courtesy (top) Oliver Iron Mining Company; (bottom) American Iron and Steel Institute

Top: Close-up view showing the tapping of a 70-ton basic electric arc furnace. Bottom: Trout Lake iron ore concentrates. More than 55,000,000 gross tons of wash ore concentrates have been shipped from this plant.

move it into ore cars on tramming levels where it is hauled by storage battery locomotives to the inclined hoisting shafts. The ores, as mined, range from 25-50 per cent iron, which is increased by magnetic concentration to better than 63 per cent iron. Concentrates are sintered before shipment to produce a suitable agglomerate for furnace charging.

Open pit and, in part, underground mining methods are employed in the western Adirondacks at two properties developed during World War II. Magnetic sintered concentrates containing in excess of 62 per cent iron are concentrated from crude ores ranging from 25-42 per cent iron. At one property sulphur in the form of pyrrhotite is concentrated with the magnetite, but this sulphur is eliminated by roasting during the sintering operation.

New Jersey.—Iron mining in New Jersey is now mostly in the Mount Hope-Dover area where the crude ore usually ranges from 25-50 per cent iron. Some of the ore contains more than 60 per cent iron and is shipped as premium lump. The magnetite-rich ore zones or lenses dip steeply and also trend or pitch northeastward in depth. Shafts either follow the dip of the ore bodies or are vertical with crosscuts driven to reach the ore. Mining is by shrinkage stoping.

Magnetic concentration raises the shipping grade of ore to 60 per cent or more in iron content. In one case where some hematite occurs with the magnetite, the hematite is recovered on vibrating tables after magnetic separation of the magnetite.

Pennsylvania.—Principal iron ore production in Pennsylvania comes from a combined open pit and underground operation near Cornwall. The crude ore contains about 35-45 per cent iron, 0.1-0.6 per cent phosphorus, 0.5-2.0 per cent sulphur and 0.2-1.0 per cent copper.

The ore body pitches or extends downward at about 30°, and the upper portion of it is mined as an open pit which is nearly a mile long, 1,000 feet wide and 600 feet deep. The open pit ore is churn-drilled and blasted in benches ahead of power shovels which load into trucks. These dump into an inclined skip which delivers ore to a crushing plant from which it is transported by rail to the concentrator.

Open stope, shrinkage stope, and block caving (described under *Western District* below) mining methods are used underground, and ore is hauled in tram cars to an inclined shaft for hoisting to surface.

The ore requires crushing and fine grinding, after which magnetic concentration, jigging, and tabling are necessary to yield a magnetic concentrate containing more than 55 per cent iron. This concentrate is sintered before shipment. Copper is recovered as a byproduct during concentration.

Western District.—Most western iron ores are magnetites, or mixtures of hematite and magnetite, mined by open pit methods.

Wyoming.—Hematite associated with iron formation of Lake Superior type is mined by underground methods near Sunrise, Wyoming. This ore body was originally mined as an open pit, but all mining is now underground where block caving is used very successfully. After extensive development of a level, the ore to be caved is undercut and the weight of the overlying rocks crushes the ore. It is then drawn off through chutes into mine cars. This mining method re-

quires careful supervision of the manner of drawing, in order to prevent dilution of the ore with waste rock. The Sunrise ore is shipped by rail to Pueblo, Colorado.

Utah.—The ore bodies being mined in Utah have very little overburden and are well suited for mining by open pit methods. The first Utah iron mines were developed with tunnels driven into hillsides beneath the ore. The tunnels were connected to open pits or "glory holes" by vertical openings. The ore was milled to these openings and trammed on tunnel levels to railway shipping pockets. All mining is now by open pit methods at Iron Mountain, where the ore is loaded by electric power shovels into trucks which dump into a crushing and screening plant from which the ore flows by gravity into railway cars for shipment to furnaces near Provo, Utah.

During World War II, other open pit operations at Iron Mountain and Iron Springs shipped ore to Pueblo, Colorado and Fontana, California.

California and New Mexico.—Open pit mines in California and near Hanover in New Mexico use power-shovel, trucking operations.

Missouri.—Principal production of iron ore in Missouri comes from Iron Mountain where mining started in an open pit; it is now an underground operation. The ore is concentrated by jigging and tabling, and the product, containing about 55 per cent iron, is shipped to Granite City, Illinois.

Numerous small brown ore pits, mostly in southeastern Missouri, produce ore as market conditions warrant.

Texas.—Open pit mining of northeastern Texas brown iron ores started during World War II. The crude ore contains about 27-42 per cent iron which is concentrated to about 53 per cent iron. Peacetime mining operations depend largely on local consumption.

FOREIGN COUNTRIES

The only countries besides the United States which have adequate coking coal reserves together with iron ore supplies, domestic or imported, to support major iron and steel industries are (1) the Soviet Union; (2) France with Germany; (3) Great Britain; and (4) possibly India and Australia. Major sources of iron ore used by these countries are reviewed below.

Soviet Union.—The chief Russian iron mines are located near Krivoi Rog in the Ukraine and at Magnitogorsk in the Ural Mountains. The Krivoi Rog area produces about 60 per cent of Russia's iron ore from underground mines where sublevel stoping or caving methods are used to mine lens-shaped ore bodies more than 2,000 feet long and equally deep. The ore averages about 57 per cent iron, 8 per cent silica, and 0.05 per cent phosphorus, and, together with coal from the Donets Basin, forms the nucleus of an important iron and steel industry.

The Magnitogorsk ore ranges from 45-60 per cent iron and is mined by open pit methods. This ore is shipped eastward by rail nearly 1,500 miles to the Kuznetsk steel plant in the Kuzbas Basin coal fields, and coal is carried on the return trip to a steel plant near Magnitogorsk. These steel plants played an important part in Russia's war effort after the Ukraine was overrun by the Germans during 1941.

France.—France's production of iron ore is usually second only to that of the United States.

The steel industry of France is concentrated in the Lorraine Basin of northeastern France where large deposits of minette iron ore of sedimentary origin occur. Minor quantities of ore extend into nearby Luxembourg and Belgium. The minette ores resemble the Clinton ores of the Birmingham district in America and, as mined, most of the ore averages about 30 per cent iron, 0.7-0.9 per cent phosphorus, 12-20 per cent lime, and 5-10 per cent silica. Some siliceous phases contain from 12-25 per cent silica. The ore beds are flat-lying and are mined underground from vertical shafts. A retreating room and pillar mining method is used, and pillars are left to support the surface. Mechanical loaders, conveyor belts, and shaker conveyors are used in some of the mines.

Minette ores are exported to the coal fields of the Ruhr and Saar valleys as well as to Belgium and Luxembourg, and coal is imported from these areas for the French iron and steel industry.

Germany.—Previous to 1918, while Germany controlled Lorraine, the minette ores supplied most of Germany's iron ore requirements. With the loss of Lorraine after World War I, domestic iron ore deposits were developed which contain only about 30 per cent iron with 25 per cent silica. These lean ore bodies were mined chiefly by underground methods, with shafts ranging to 2,000 feet in depth. Production supplied only about 13 per cent of Germany's metallic iron requirements, and she was forced to import ores, chiefly from France and Sweden.

Sweden.—The major Swedish iron production is from the Kirunavaara open pit in northern Sweden or Lapland, where ore is loaded by electric power shovels into mine cars for delivery to a crusher in the pit and transported in 35-ton bottom dump cars. These are hauled by electric locomotives to Lulea on the Baltic or to Narvik, Norway for export. The ore docks at Narvik and Lulea resemble Lake Superior type docks, without storage pockets.

Other deposits in Lapland and near Grangesberg in southern Sweden are mined underground by shrinkage stoping method; these ores are crushed and concentrated to yield a high-grade, low-phosphorus product. Southern ores shipped from the port of Oxelösund are loaded on steamers either by grab buckets of 17-ton capacity or by conveyor belts.

Export ore contains about 60-62 per cent iron and 0.15-2.76 per cent phosphorus and, previous to World War II, was shipped principally to Germany and Great Britain.

Great Britain.—The iron mines in Great Britain are located chiefly in the Middlesborough, Northampton, Leicester, Frodingham, and Cleveland mining districts. The ore occurs in flat-lying sedimentary beds which are mined largely in open pits. A maximum 85 feet of cover is removed to expose ore ranging from 6-30 feet in thickness. Overburden is stripped by power shovel, chain bucket excavators, or by dragline. The ores contain only about 30 per cent iron and 0.3-0.7 per cent phosphorus. Lime and silica vary for different deposits, and bedding plants similar to those used in America are in use at some furnaces to provide a uniform furnace feed. It is necessary to import ores of better grade for use in the British iron and steel industry.

Newfoundland.—High phosphorus, Wabana

ores mined from Bell Island, Newfoundland, are exported to Europe as well as being used at furnaces in Nova Scotia, Canada. These deposits are close to American markets, but American practice has not been designed to use these high-phosphorus ores.

The Wabana ores, of sedimentary origin, occur in several beds interbedded with other sediments which dip away from Belle Island beneath the ocean bottom. Inclined double shafts follow down the dip of the beds, and mining of the ore has progressed from two to three miles beyond the shoreline at depths of 1,600 feet below sea level, equivalent to 1,300 feet below sea bottom. A room and pillar mining method is used, and from 40-50 per cent of the ore is left as pillars. Mechanical loaders, scrapers, and power shovels are used underground to load cars. The ore is crushed on the surface and moved two miles to shipping port. The shipping grade of ore averages about 51 per cent iron, 11.5 per cent silica, and 0.92 per cent phosphorus.

Other Countries.—Iron mining in other parts of the world is mostly by open pit methods. There is a wide range in the extent of mechanization of mining operations in foreign countries. In the open pit at Kirunavaara, Sweden, power shovels and mine cars are of American make, and this mining operation compares favorably with the best American practice. In contrast, in densely populated India where labor is cheap, iron ore is carried in baskets by natives from open cut working faces to railway cars.

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11. IRON AND STEEL, Metallography of.—Metallography deals with the crystal structure of metals and alloys, with the effect of the composition and treatment of the alloy on the structure, and, in turn, with the way the structure affects the properties. Metals are made up of crystals similar in appearance to the crystals in a polished piece of granite. Metal crystals may be very soft and ductile or they may be very hard and brittle; they may be very coarse or very fine. The properties of an alloy may depend as much on the size, shape, and distribution of its various crystals as on the composition. The crystal structures of iron and steel are of remarkable variety, enabling metallographic study to reveal a surprising amount of information about the

composition and treatment of any particular specimen. These structures suggest how defects present may be eliminated, how desired qualities may be attained, and how new or improved alloys may be produced. Metallography is one of the most important means of production control, inspection, and research of iron and steel.

Visual Examination.—Significant structural features in iron and steel articles are frequently large enough to be observed with the unaided eye. For example, the fracture of a broken specimen may indicate whether the structure is coarse or fine, uniform or heterogeneous. The more usual procedure preparatory to visual examination is to etch deeply a section cut through the specimen with a hot solution containing one volume of water to one volume of concentrated hydrochloric acid for about 15 minutes. The etched surface will then clearly reveal the degree of fineness and uniformity of the structure, the rolling direction of a rolled article, the presence of porosity and unsoundness in a casting and cracks.

Figs. 1 and 2 illustrate typical structures of deep etched steel as they appear when viewed with the unaided eye or as magnified somewhat with a hand lens. Fig. 1 shows the dendritic or pine tree crystals which form in cast steel. The elongated crystals at the left are at the surface of the casting and the crystals at the right, of uniform diameter in all directions, are at the interior of the casting. Fig. 2 shows a section through an electric-arc weld on a steel plate. The humped region at the top is the fused-in metal from the melted electrode; directly underneath are various layers of the plate in which the structure was changed by the welding heat; beneath is the unchanged structure of the plate.

An interesting example of visual examination is the detection of cracks in steel by means of magnetic powder. The steel specimen is magnetized and fine magnetic powder is sprinkled over the surface, or the specimen is immersed in kerosene in which the magnetic powder is suspended. The magnetic powder will gather at any crack that may be present in the magnetized specimen, bridging the crack and thus making it clearly visible.

Microscopic Examination.—For revealing the finer details of the structure of iron and steel, the microscope must be used. In most cases the crystalline constituents are of such a size that their significant features can be revealed at the moderate magnification of X100. Frequently a higher magnification such as X500 is necessary. The limit of useful magnification of the optical microscope is about X2000. The newly invented electron microscope has been applied to the study of metals. In this way magnifications as high as X20,000 and higher have been attained. On a still finer scale, the positions of the atoms in the unit cells or lattices of which crystals are composed can be determined by X-ray diffraction analysis. In iron these unit cells are of the cubic type. At temperatures below 1670° F. for pure iron, the lattice is *body* centered cubic, known as *alpha*, or alpha iron, an iron atom being present at each corner of the cube and in the center of the cube. On heating pure iron above 1670°, the lattice changes to *face* centered cubic, known as *gamma*, or gamma iron, an iron atom being present at each corner of the cube and in the center of each face of the cube. At 2552° F., the lattice again

changes to *body* centered cubic, known as *delta* or delta iron. The two types of cubic lattice in iron are illustrated in Fig. 3. Alpha iron can dissolve up to 0.035 per cent carbon and larger amounts of other alloying elements, and the resulting solid solution is called *ferrite*; gamma iron can dissolve up to 1.7 per cent carbon and varying amounts of other alloying elements, and the resulting solid solution is called *austenite*. The amount of the elements dissolved in the alpha iron and gamma iron depends upon the maximum temperature attained and the time during which the iron is at this temperature. The amount of the elements retained in the dissolved state in the solid iron depends upon the cooling rate from the maximum temperature, any subsequent reheating and cooling, and the preferential effect of one element upon the solubility in iron of the other elements. The length of a side of the body centered unit cube of iron (as illustrated in Fig. 3) is approximately 1/100 of a millionth of an inch.

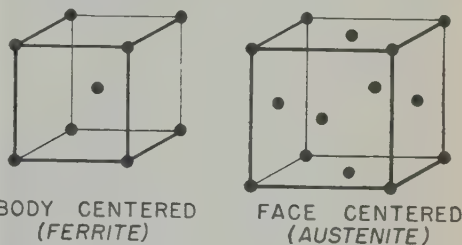


FIG. 3. Constitutional diagram of iron and iron carbide.

Before a specimen can be examined under the microscope the surface to be viewed must be properly prepared. The usual method is to grind and polish a section cut through the specimen. The polished surface of the specimen must usually also be etched to reveal the crystal structure fully. Metals are opaque so that you cannot see through them by transmitted light as in the case of some minerals; they have to be observed by reflected light. In grinding and polishing, a convenient sized specimen having one side about ½ square inch in area is first ground on a coarse emery wheel, then on finer emery papers, and finally polished with polishing cloth mounted on a wheel. In this final stage a very fine abrasive like alumina suspended in water is applied to the polishing cloth. The polishing action should be a cutting action as much as possible, and also should be mild, so as not to flow and smear metal over the surface. Many structural features may be observed in the as-polished condition, but usually the specimen is also etched. Light etching as with 2 per cent nitric acid in alcohol for about 15 seconds is usually sufficient. After etching, the specimen must be rinsed, washed in alcohol, and carefully dried. Metallography is a fine art, and beautiful results can be obtained when the structures are properly revealed.

Figs. 4 and 5 show the structures, as magnified by the microscope, of the same specimens as are illustrated in Figs. 1 and 2 without appreciable magnification. Fig. 4 shows the coarse, angular type of structure which may appear in steel in the as-cast state. Fig. 5 illustrates the structures at the weld of Fig. 2. In Fig. 5 the fused-in metal of the weld is at the left and

the first layer beneath the fused-in metal, illustrated in Fig. 2, is at the right. The dark, vertical, diamond-shaped impressions in Fig. 5 were made for testing the hardness, the smaller the impression produced by the test load, the greater the increase in hardness. The fused-in metal at the left of Fig. 5 is softer (larger impression); the metal at the layer at the right is harder (smaller impression).

Fig. 6 illustrates coarse- and fine-grained structures in steel. Specimens *A* and *B* were steels of similar composition heated in the same way for 8 hours at 1700° F. in a carburizing compound, consisting mainly of powdered coke. Steel *A* became coarse; steel *B* remained fine. The fine-grained type of steel can be produced by adding to the molten steel about 2 pounds of aluminum per ton of steel. The fine-grained type

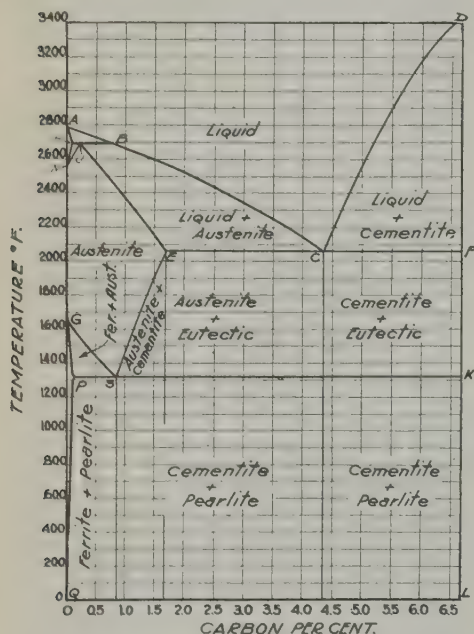


FIG. 9.

of steel is tougher than the coarse-grained type, but both types have advantages for certain purposes.

In Fig. 7, *A* is typical of the grain structure of low carbon iron or ferrite; Fig. 7, *B* shows the same spot as 7, *A* after the sample was cold worked. The parallel lines in Fig. 7, *B* are slip lines which formed as a result of the cold working. The effect of cold work is to harden the iron. With proper technique the cubic crystal habit of ferrite grains may be revealed. This is illustrated in Fig. 8.

Constitution of Iron Carbon Alloys.—

Low carbon iron, steel, and cast iron all belong to the series of alloys of iron and carbon. One of the best ways of indicating fundamental differences among these alloys is the constitution diagram of the iron-carbon alloys. In Fig. 9 may be seen the whole series of alloys of iron and carbon; from carbon-free iron at the left, to alloys containing 6.7 per cent carbon at the

right. The effect of temperature on these alloys from 0° F. to above their melting point is also indicated.

Steels are the most important iron-carbon alloys. The steels range in carbon content from about 0.1 per cent carbon to about 1.5 per cent carbon. Beyond this carbon content, from about 2 per cent carbon to about 4.5 per cent carbon, are the alloys known as the cast irons.

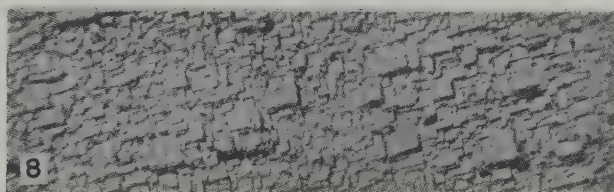
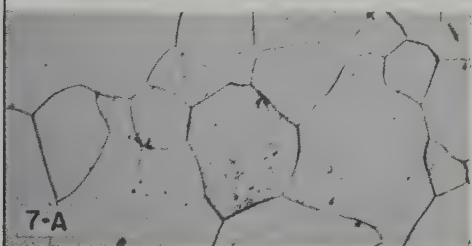
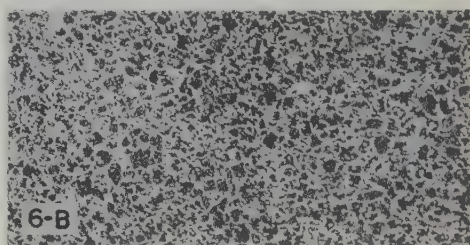
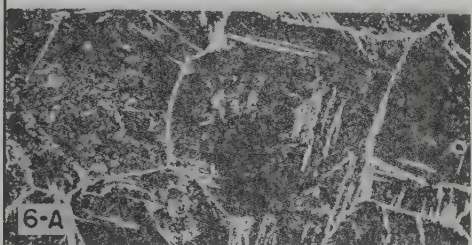
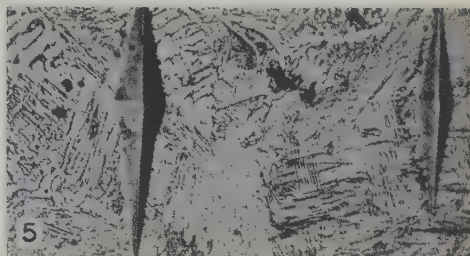
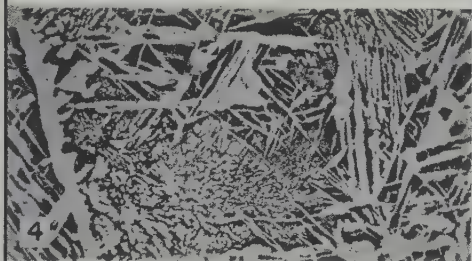
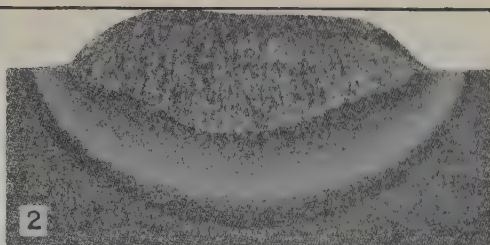
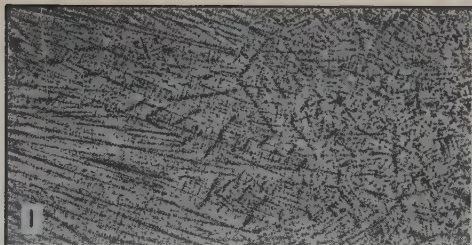
It may be seen in the diagram of Fig. 9 that as the carbon content of the alloys goes up, the solidification temperature goes down. Thus pure iron completely solidifies at the very high temperature of about 2800° F. But steels completely solidify at lower temperatures, as indicated by the boundary line *JE*. Above the line *JE* some "liquid" is present along with the "solid austenite," whereas below the line *JE*, only solid austenite is present. At the point *E* an alloy of 1.7 per cent carbon completely solidifies at about 2100° F. All alloys higher than this in carbon (including the cast irons) completely solidify at about 2100° F., along the line *ECF*. The composition at the point *C* on this line is the alloy of iron and carbon with the lowest melting point. This is called the eutectic composition, the word *eutectic* signifying lowest melting point. The cast irons are close to the eutectic in composition, and their consequent low melting point is one of the main reasons why cast irons are used. The cast irons are much more easily melted than the low-carbon steels; they can be made very fluid and, therefore, make good castings.

Carbon is the hardening constituent in steel. In slowly cooled steel, carbon is present as a hard, iron-carbon compound (iron carbide) called *cementite*. In steels with less than about 0.8 per cent carbon, the carbon is incorporated in the constituent called *pearlite*, which consists of alternate lamellae of ferrite and cementite. In slowly cooled steels with less than 0.8 per cent carbon, the constituents present are ferrite and pearlite as indicated in Fig. 9 in the region below the line *PS*. In slowly cooled steels containing more than 0.8 per cent carbon, ferrite is no longer present; in these alloys, the carbon up to 0.8 per cent carbon is present as the cementite lamellae in pearlite; the rest of the carbon forms cementite boundaries about the pearlite grains.

As indicated in Fig. 10, low-carbon steel consists mainly of ferrite with some pearlite. The ferrite is the light constituent and the pearlite, the dark constituent. As the carbon content increases, the amount of pearlite increases and the amount of ferrite decreases. In slowly cooled steel with about 0.8 per cent carbon, the structure consists entirely of pearlite. Obviously, pearlite has a composition of approximately 0.8 per cent carbon.

In slowly cooled steels which have a carbon content greater than that of pearlite, cementite (iron carbide) forms boundaries about the grains of pearlite. This is illustrated in Fig. 11, *A*. These rather thin cementite boundaries (the cementite is light colored) may be seen in about the center of Fig. 11, *A*, where several boundaries join. Fig. 11, *A* also illustrates the details of the structure of pearlite. The alternate lamellae in pearlite produce a fingerprint pattern which is easily recognized when viewed at the proper magnification. In Fig. 11, *A*, in which the fingerprint structure is clearly visible, the magnification is X500. In Fig. 10, at X100, the magnification is too low to resolve the fingerprint pattern of the

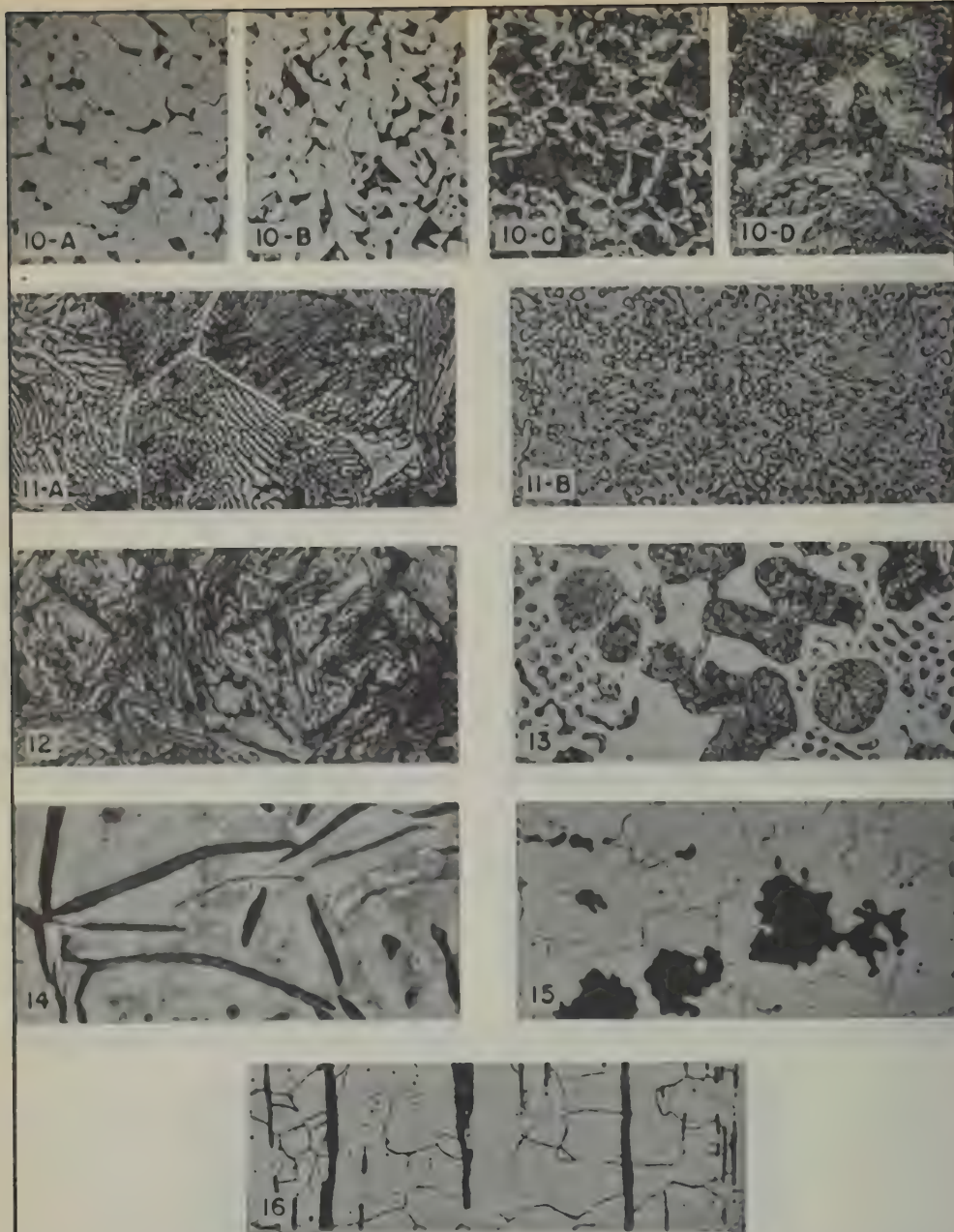
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1. Pine tree crystals in steel casting X3.
2. Structure of electric-arc weld in steel plate X4.
4. Typical structure of cast steel X40. Same specimen as in Fig. 1.
5. Variation in structure and hardness in region of weld X400. Same specimen as in Fig. 2.

- 6-A, B. Coarse- and fine-grained types of steel X10.
- 7-A. Typical structure of iron X500.
- B. The same structure as A, after cold working.
8. Cubical crystallites revealed in slowly cooled iron X900.

IRON



- 10 Relative amounts of ferrite and pearlite in slowly cooled steels of increasing carbon content up to 0.8 per cent carbon, X100. The ferrite is light and the pearlite is the dark constituent. A, 0.11 per cent carbon; mainly ferrite with some pearlite. B, 0.20 per cent carbon; less ferrite than A and more pearlite. C, 0.46 per cent carbon; there is now more pearlite than ferrite. D, 0.80 per cent carbon; substantially all pearlite.
- 11 Structures of 1.20 per cent carbon steel X500. A, pearlite with cementite grain boundaries. B, ferrite groundmass with cementite globules.

- 12 Structure of quench-hardened steel X500. This acicular or needlelike structure which forms in quench-hardened steel is called "martensite."
- 13 Structure of white cast iron X500. The white areas are massive cementite, the dark areas are pearlite.
- 14 Structure of gray cast iron X100. The large black plates are flakes of graphite; the groundmass is composed of pearlite and some ferrite.
- 15 Structure of malleable cast iron X100. The black patches are graphite nests; the groundmass is ferrite.
- 16 Structure of wrought iron X100. The matrix is ferrite. The dark parallel streaks are slag.

pearlite.

The steel of Fig. 11, *B* has about the same carbon content as Fig. 11, *A*. By a special heat treatment the cementite (iron carbide) was coalesced into globules to form "spheroidized cementite." The structure consists of a ferrite groundmass containing the cementite globules. A steel having such a structure is considerably softer than a steel of the same composition in which the structure consists of pearlite and cementite boundaries as in Fig. 11, *A*.

Hardening of Steel.—Many steels for engineering structures are used in the slowly cooled (air-cooled) condition, and these steels owe much of their hardness and strength to the presence of pearlite, as has been indicated above. However, a much higher order of hardness is obtainable if the steel is cooled very rapidly from above its critical temperature, instead of being allowed to cool slowly. Such rapid cooling from above the critical temperature, as by quenching the hot steel in cold water, is what is meant by "hardening." Reference to Fig. 9 of the iron-carbon constitution diagram will be helpful in explaining what takes place in the quench hardening of steel.

As previously described, iron exists in two forms, as ferrite below the critical temperature and as austenite above the critical temperature. The critical temperatures are indicated by the lines *PSK* and *GSK* in Fig. 9. Above the line *GSK* the iron is present as austenite; below the line *PSK* it is present as ferrite; between *PS* and *GS* there is a mixture of ferrite and austenite, as indicated by the arrow in the diagram. Hardening can occur mainly because the austenitic form of iron can hold a large amount of carbon in solution, whereas ferrite can hold only a minute amount of carbon in solution. It is indicated in Fig. 9 that austenite can hold as much as 1.7 per cent carbon in solution whereas ferrite can hold only about 0.035 per cent. If a steel is cooled slowly from above the critical temperature, the carbon can separate when the critical temperature is traversed, and the austenite changes to ferrite and cementite. But when the steel is very rapidly cooled through the critical temperature, there is not time enough for the cementite to separate. The austenite transforms to ferrite but the cementite does not separate. The bulk of the cementite is, therefore, retained in the ferrite in supersaturated solution, although some of the cementite precipitates as an extremely fine (submicroscopic) dispersion. The extreme hardness of quench-hardened steel may be attributed to the supersaturated solution and fine dispersion of the cementite in the ferrite.

Fig. 12 shows the acicular or needlelike constituent which forms in steel when hardened by quenching from above the critical temperature. This constituent is called *martensite*. Martensite is extremely hard and it is the structure desired in steel for metal-cutting tools, files, and cutlery. Extreme hardness generally denotes brittleness. Thus as-quenched martensite may be too brittle. Quench-hardened steel can be made tougher and less brittle by heating it somewhat after quenching. Such heating is called tempering. The higher the tempering temperature, the softer and less brittle and the tougher is the steel. The quenched and tempered structure, is therefore the commonly sought structure in heat-treated steel. The tempering

temperature is determined by the hardness required in the finished article. For extreme hardness the tempering temperature may be about 400° F.; for great toughness the tempering temperature may be as high as 1200° F. During tempering the cementite separates from the martensite. At the higher tempering temperatures the cementite coalesces into particles large enough to be resolved in the microscope. After tempering at about 1200° F., the cementite appears as the good-sized globules of spheroidized cementite illustrated in Fig. 11, *B*.

Effect of Alloying Elements.—A word may be said about the effect of the alloying elements in steel, such as nickel, chromium, molybdenum, vanadium, and others. The alloying elements may be present in solution in the ferrite, and some of them may also be combined with carbon and one another to form carbides. In this way they may exert a considerable strengthening effect. However, the main effect of the alloying elements is in slowing down the rate at which austenite transforms to ferrite and cementite during cooling through the critical temperature region. As a result, instead of requiring extremely fast cooling from above the critical temperature to produce martensite as in plain carbon steel, very much slower cooling from above the critical temperature is sufficient to produce martensite in alloy steel.

The importance of this will be clear from the following example. A 1-inch diameter bar of plain carbon steel, which is heated to a temperature above the critical temperature and then immediately quenched in cold water, will cool rapidly enough to form martensite, only at the surface. Martensite will be formed only to a depth of about $\frac{1}{8}$ inch. In the interior of the plain carbon steel bar the rate of cooling even in cold water will be too slow to form martensite. On the other hand, in a 1-inch bar of alloy steel similarly quenched or even more slowly cooled, as by quenching in oil, the martensite will form throughout the bar. Accordingly, the main effect of the alloying elements is to make possible very deep hardening of large sections, and likewise the attainment in large sections of the desired quenched-and-tempered tough structures. In thin sections, as in wire, just as high strength and toughness can be obtained with plain carbon steel as with many alloy steels.

Cast Iron.—The place of the cast irons in the iron-carbon constitution diagram of Fig. 9 has already been discussed. In these high carbon alloys the carbon may be present as cementite or as graphite.

Cast iron in which all of the carbon is present as cementite is called white cast iron. It contains about 3 per cent carbon and about 0.5 per cent silicon. The structure of white cast iron is illustrated in Fig. 13. The large white areas are massive cementite and the dark areas are pearlite. Because so much of the very hard constituent cementite is present, white cast iron is extremely hard and brittle. It is used for such purposes as grinding balls in ball mills and chilled rolls for rolling metal.

In gray cast iron most of the carbon is present as flakes of graphite. The structure of gray cast iron is illustrated in Fig. 14. For the carbon to be present in the form of graphite instead of cementite, the alloy must contain a good deal of silicon, which promotes graphitization. Ordinary gray cast iron contains about 3.5 per

cent carbon and about 1.75 per cent silicon. The groundmass structure of gray cast iron is pearlite and ferrite and hence is quite tough, but it is broken up by graphite flakes so that the iron is brittle. The graphite in gray cast iron improves its machinability, however, and castings of this material find applications in automotive cylinder blocks and pistons, stoves, radiators, and many other products.

Another variety of cast iron is called malleable iron, the structure of which is illustrated in Fig. 15. This contains about 2.5 per cent carbon and about 1.25 per cent silicon. The silicon content is low enough for the alloy to solidify as white cast iron, but there is enough silicon present to promote graphitization in the subsequent heating or annealing process to which this type of casting is subjected. This malleablizing annealing is done in two stages, first by heating at about 1600°F. in order to graphitize the massive cementite, and then by heating at about 1325°F. in order to graphitize the last remnants of pearlitic cementite. In malleable iron the graphite which forms during the malleablizing annealing is present as rounded nests (Fig. 15), rather than as elongated, sharp flakes, as in gray cast iron (Fig. 14). Because of this, and because the matrix of malleable iron is composed entirely of soft ferrite, malleable iron has considerable toughness and is not brittle, as is gray cast iron.

Wrought Iron.—Unlike cast iron, which is a high-carbon cast material, wrought iron is a substantially carbon-free forged or rolled material. It is distinguished by the fact that during its manufacture slag is incorporated in its structure. The elongated slag streaks in a wrought iron bar are illustrated in Fig. 16. These streaks impart a fibrousness to the structure.

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12. IRON AND STEEL INDUSTRY IN THE WESTERN HEMISPHERE.

The iron and steel industry has developed over a period of three centuries in the United States, about two centuries in Canada, since the 1880's in Mexico, and mainly after World War II in South America. In the 1950's the industry in the United States well supplied the domestic demand for iron and steel. Of the other countries in the Western Hemisphere, Canada was best able to meet its demand.

Although the Western Hemisphere contains some of the principal iron ore and coal reserves of the world, those mined extensively before World War II were all located in the United States and Canada. The postwar development of iron ore deposits in South America stimulated the expansion of the Latin American iron and steel industry and assured the United States of additional sources of iron ore.

The following sections describe the iron and steel industry in the United States, Canada, Mex-

ico, Argentina, Brazil, Chile, Colombia, Peru, and Venezuela.

UNITED STATES

The basic importance of the iron and steel industry in the economy and welfare of the United States may be glimpsed from a few facts. Iron and steel are the most widely used of all the metallic materials and are also the most necessary in modern civilization. The 1954 United States raw steel output of 88,311,652 net tons was about 36 per cent of the world output of 246,292,759 net tons, and the country's estimated per capita output for the year was 1,097 pounds.

Nearly 40 per cent of all the jobs in the manufacturing industries of the United States are created by the domestic manufacture and industrial uses of iron and steel. This industry is so intimately associated with the national economy that it is difficult to name one item of food, clothing, shelter, convenience, or luxury that does not contain iron or steel or is not made, transported, or consumed with the aid of iron or steel equipment. Consequently, the activity of the iron and steel industry is a basic indicator of the economic health of the country.

In 1954 it was estimated that an investment of more than \$75,000 in construction and equipment was required to make a job for just one man in the iron and steel industry. That investment is one measure of the huge scale of operations, a scale which enables the industry to produce iron and steel abundantly and at prices that permit their use in 200,000 products. The estimated price of steel in a few of these products, together with their estimated retail price, is shown in Table 1.

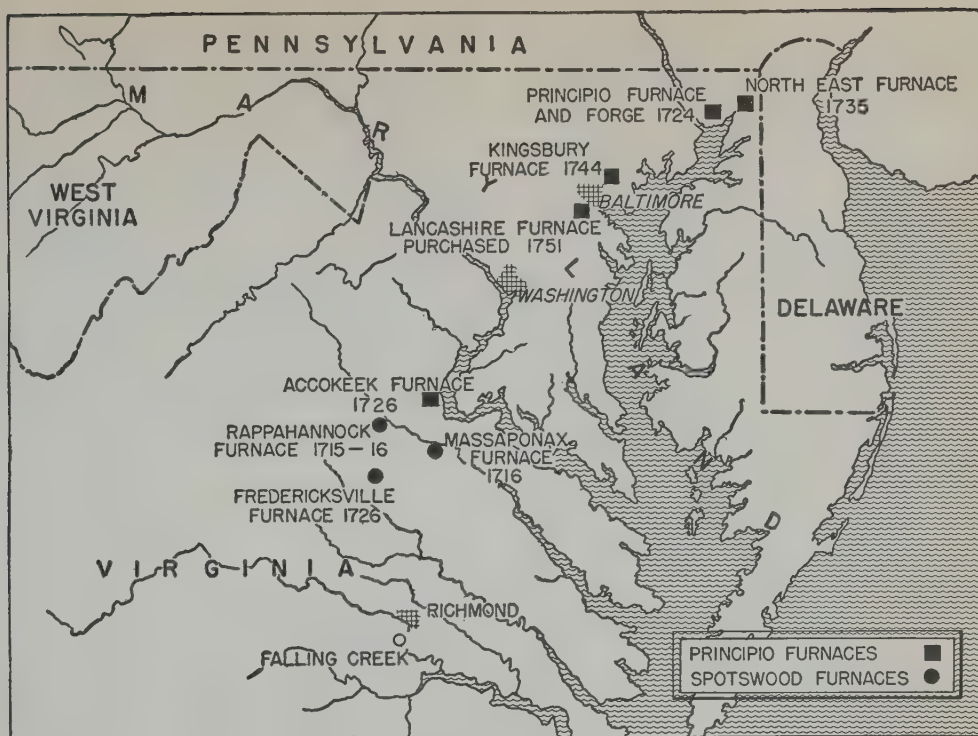
Table 1—RETAIL PRICE AND PRICE OF STEEL FOR SELECTED PRODUCTS

(Estimated as of March 1953)

Product	Estimated retail price of product	Estimated price of steel in product
Automobile	\$1,984.00	\$225.00
Baby carriage	29.95	2.25
Electric iron	11.95	.47
Electric shaver	27.50	.10
Range	370.00	13.80
Refrigerator	350.00	13.56
Toaster	21.95	.72
Typewriter	165.00	3.85
Vacuum cleaner	89.95	1.60

The importance of iron and steel in the growth of the United States is evident in the founding and development of the industry during the colonial period and in the expansion of the industry since the mid-19th century. Succeeding sections describe (1) the colonial iron industry, (2) the colonial steel industry, and (3) the expansion of the industry from 1783 to 1864. The latter year marks the beginning of large-scale steel manufacture by the Bessemer converter in the United States. The fourth and final section, covering the period since 1865, treats the modern era of the industry, during which steel first became available in large quantities at low cost, and thousands of varieties of iron and steel were developed for particular uses.

Colonial Iron Industry.—A combination of unusual circumstances attended the founding of the iron and steel industry in what is now the United States. Workable low-grade deposits of iron ore existed along the Atlantic seaboard in practically all of the colonies. Also abundant were virgin forests and easily dammed streams; the former furnished fuel for the furnaces, and the lat-



Map 1. Beginnings of the Southern iron industry.

ter water power for the air blast and forge hammers. Slow communications with Europe and restrictive English laws and trade practices encouraged the colonists to work these deposits and to make iron products for local consumption.

The English Parliament might have severely handicapped the development of the colonial iron industry if timber had been plentiful in England or if iron smelting had been more advanced technically. In the 17th century charcoal was the only fuel used in blast furnaces and forges, and wood in the form of charcoal was being consumed more rapidly than it could be grown in England. The shortage of timber alarmed the English government, which was trying to maintain naval supremacy and expand trade. Consequently, English ironworks were prohibited from using timber suitable for shipbuilding within 14 miles of the sea or any navigable river. England therefore became an importer as well as a producer of iron. Had English ironworkers known that the readily available coal or coke could be used to smelt iron ore, the iron industry in colonial America might not have been established in the 17th century. Since it was English colonial trade policy to import raw materials from the colonies and export finished products, it is very probable that English ironworks would have supplied the American colonies with iron and iron products.

17th Century.—Although iron ore was discovered on an island off the shore of North Carolina in 1585, no colonial deposit was worked until 1608, when ore discovered in the previous year along the James River, Virginia, was shipped by the East India Company to England. For the first shipment of 17 tons the colonists received

£68. By 1619 the Society of Southampton Hundred (Southampton Adventurers) planned to build three ironworks in Virginia, under patents granted by the Virginia Company of London (London Company), to smelt the ore that occurred in ponds and bogs. Falling Creek, near the present city of Richmond (see Map 1), was intended to be the site of the first of these works. It has been reported that a furnace was built in 1622, that on the day it was scheduled to begin operations Chief Opechancanough and his braves massacred the settlement of 348 (save for a boy who escaped to Jamestown), and that the society abandoned its plans to build the other works. Examination of the reported furnace site and other possible sites and of contemporary and later documents has not conclusively indicated the existence of a furnace.

In June 1641, the General Court of Massachusetts Bay Colony offered "encouragement to the discovery of mines," for the young colony needed iron, and iron minerals had been discovered in eastern Massachusetts. This public offer and technical information on local iron deposits led the younger John Winthrop (q.v.) in the summer of 1641 to enlist the aid of investors in England and the colony to form the Company of Undertakers for the Iron Works in New England. By a vote of the Boston Town Meeting in February 1644, he received a grant of 3,000 acres of the common land at Braintree. It is probable that Winthrop erected a blast furnace at Braintree between 1644 and 1647, and that construction of a finery and chafery was begun during 1644 or 1645. The blast furnace was not successful, but the finery and chafery ultimately processed iron produced at Saugus. In March 1644, the colony

granted the company a 21-year monopoly to manufacture iron (provided it would meet the inhabitants' needs for iron within 2 years), with free use of wastelands, the privilege of erecting furnaces and forges in six places, exemption from general taxation, and the right to export iron when local demand had been satisfied. The General Court set a maximum sales price of £20 per ton of bar iron.

During 1646 and 1647, Winthrop's company built the first successful ironworks in America in the village of Hammersmith on the banks of the Saugus River near Lynn, Mass. The works, known historically by the names "Hammersmith" and "Saugus," comprised a blast furnace, two fineries, a chafery, and a rolling and slitting mill. The blast furnace produced pig iron from a mixture of local bog ore and ore from Nahant with charcoal—a mixture sufficiently self-fluxing so that additional flux, such as limestone or oyster shells, was not required. The pig iron output during August 1648 was at the rate of 7 tons a week. The works also produced bar iron and such finished products as cannon balls, hammer heads, pliers, pots, saws, scale weights, scythes, shovels, and skillets. In its day the Saugus works was a large-scale industrial plant and a prototype of United States heavy industry in general. Individuals evaluated the chances of success in a new venture, organized a company, risked their capital, bargained with the colonial government for the best terms on which to undertake the venture, hired specialists to build and operate the works, and participated in its management. The Saugus plant is considered the birthplace of the United States iron and steel industry. Of greater importance, it is the plant at which American colonists broke with many European traditions concerning the relationships of industry to government, management to labor, and state to church. The significance of this plant in the economic, social, and religious development of the United States is commemorated in its reconstruction, completed in 1954 by the First Iron Works Association of Saugus, Mass.

The Saugus works employed freemen, indentured servants, and, occasionally, Indians. Except for the indentured servants and a few skilled freemen, most of the workers were part-time employees who also worked on their farms or at trades. Highly skilled workers, such as the foreman of the blast furnace and the workman in charge of the water-powered blowing engine, were specialists, but the rest generally were not. Felling timber, sawing wood, making charcoal, weaving baskets for ore or charcoal, digging ore, and weighing iron provided variety in work and wages. Typical weekly wages in 1650 were \$6.60 for making charcoal and \$8.65 for charging the blast furnace with raw materials. The work week was six days from sunrise to sunset. A day's wage for weighing iron was 85 cents; for cutting the iron into marketable shapes, \$1.40. The company's charter exempted the workmen from all public charges, taxes, military service, and "watching for Indians." For about 50 full-time workers and an unknown number of part-time workers annual cash payrolls are estimated to have been \$8,000; to this should be added \$12,000 for housing, feeding, and clothing 35 indentured servants who received no cash wages.

The many deposits of iron ore scattered along the Atlantic seaboard, together with an abundance of wood and water power, soon provided an iron-

works in or near practically every large community. During the third quarter of the 17th century the industry was concentrated in Massachusetts and Connecticut. During the last quarter ironworks were established in northern New Jersey to smelt magnetic iron ores, which were richer than the New England bog and pond deposits.

The pig iron made in colonial blast furnaces was raw material for casting into molds for such articles as firebacks, kettles, pots, salt pans, skillets, and stove parts. It was also raw material for the manufacture of one kind of colonial bar iron, in which the cast iron was refined on a hearth to remove excess carbon. The pig iron was usually cast into sand molds directly from the blast furnace. A cast iron pot of about one-quart capacity, cast directly from the Saugus blast furnace, was the first product of colonial iron manufacture. The other type of colonial bar iron was obtained by heating iron ore with charcoal on a bloomery hearth without melting the extracted iron. This was a crude form of wrought iron. When carefully made, it had a carbon content sufficiently low so that the iron was malleable and ductile. It was forged or hammered into bars, which in turn were reheated and hammered into ax heads and other tools, bolts, hinges, pothooks, shutter hooks, agricultural implements, wagon tires, horseshoes, and household articles.

18th Century.—In the first half of the 18th century ironworks were built in New York, New Jersey, Pennsylvania, Delaware, Maryland, and Virginia. While Massachusetts and New Jersey were the leading iron producers during the last quarter of the 17th and the first quarter of the 18th centuries, Pennsylvania rapidly challenged their lead. In Pennsylvania, as in other colonies, lack of cheap transportation necessitated the location of ironworks near ore deposits, forests of oak, hickory, ash, chestnut, or pine, water power, labor, food supplies, and, in many instances, the market for cast and bar iron.

In the 18th century iron plantations flourished in Pennsylvania. An iron plantation was essentially a self-contained community, analogous to an Irish feudal barony. Its proprietor, like a Virginia tobacco planter, was in effect the governor of a community that depended on him for its welfare as well as its livelihood. Some of the iron plantations embraced as much as 10,000 acres. One of them was restored by the National Park Service at Hopewell Village, 6 miles southeast of Birdsboro, Berks County, Pa. Known as the Hopewell Village National Historic Site, it was established in 1938.

Beginning with a bloomery forge built by William Bird in 1743, the Hopewell plantation expanded until its population reached about 1,000. Included in it were an iron mine about 2 miles from the center of the village, forests in which wood was cut and made into charcoal, charcoal storage houses, and an ore roaster. There were also a dam with two headraces and a tailrace, a mill wheel, a blast furnace, a bridge over the west headrace to the blast furnace, slag piles, a casting house, a blacksmith shop, a wheelwright shop, tenant houses, barns, farms, a springhouse, a bakehouse, corncribs, a combination office and store, a carriage house, a schoolhouse, and the proprietor's mansion. The schoolhouse was probably also used as a church. The plantation produced iron for industrial use and iron cast into stoves and hollow ware. Most of the products

were shipped by boat or horseback to Philadelphia, the remainder being consumed on the plantation.

The geographical trend of the colonial iron industry to the west and south, as shown on Map 2, brought the first ironworks to Kentucky, Tennessee, and Georgia during the last quarter of the 18th century. While ironworks were in operation in both North Carolina and South Carolina prior to the American Revolution, the date of erection of the first ironworks in North Carolina is not clearly established. The westward and southward trend of the iron industry continued throughout the 19th century, when ironworks were established in Alabama, Arkansas, California, Colorado, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Ohio, Oregon, Texas, Utah, Washington, Wisconsin, and Wyoming.

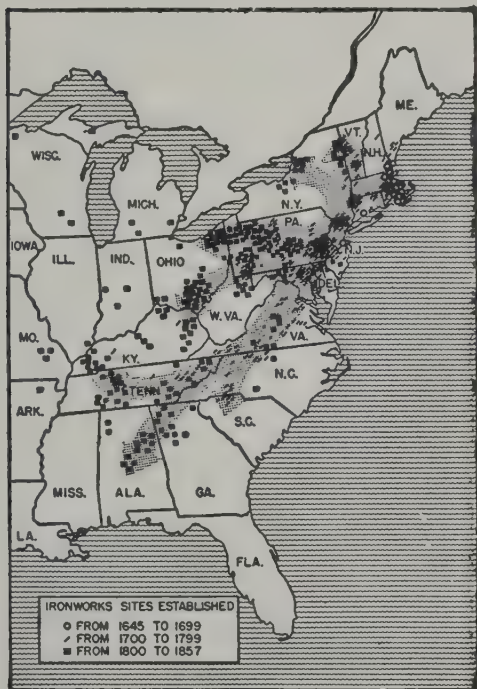
Measurements of the ruins of colonial blast furnaces suggest that the typical furnace was a

Periodically the slag and iron were drawn off through separate tapholes or notches, the slag hole being at a higher level than the iron hole. The charcoal was burned by a blast of cold air which entered the furnace just above the hearth. A large pair of bellows, usually made of leather, was operated by a water-driven wheel to supply the air or blast. Overshot water wheels in diameters up to 30 feet were used. In some instances a considerable area of land had to be flooded in back of an ironworks dam in order to provide the volume of water and drop in height required for water wheels. At the Saugus works, for example, about 1,000 acres were submerged. In northern colonies, where freezing weather prevailed during the winter, ironworks were usually idle when the water wheel froze.

Terms such as "bloomery," "forge," "finery," "refinery," "chafery," "ancony," "sowe iron," "pig iron," "bar iron," and "merchant bar" were in common use in the colonial iron industry, and some of them have persisted. Bloomery, also spelled bloomary, has several distinct meanings. One type of furnace in which an iron bloom was made directly from iron ore was known as a bloomery or forge and also as a block oven or block furnace. The term "bloomery" also referred to an ironworks consisting of a forge, a hammer for working the bloom, and a blowing engine to supply air to the forge. Similarly, the term "forge" was used interchangeably with "bloomery" to include the equipment. Many ironworks had a heating furnace to reheat blooms as well as other iron products before pressing or squeezing them under the hammer; the terms "bloomery" and "forge" also included this furnace.

A refinery was a furnace with a hearth similar to that in a bloomery furnace, in which pig iron from the blast furnace was placed in a charcoal fire to refine it into a malleable condition. In some processes iron ore was added to the hearth to assist in the refining. The main objective was to remove excess carbon, which made the pig iron too brittle for working either hot or cold. The refinery was also called a charcoal finery or charcoal refinery. The product of a refinery was a chunk of plastic and nearly white-hot iron called a half bloom, which was placed on an iron anvil and pounded with an iron hammer to squeeze out the molten slag. The hammered half bloom was reheated to a bright red color and rehammered to remove more slag. This operation yielded an ancony, which was a thick bar, rectangular in cross section, with a rough knob at each end. The term "ancony" applied broadly to a bloom which had been worked under a hammer to the required width and thickness except at the ends, which were not hammered. The ancony was an article of commerce. If it was further processed, it was placed in a chafery, a reheating hearth, and then hammered into bar iron, in dimensions up to 14 feet long, 2 inches wide, and $\frac{1}{2}$ inch thick. When cut into convenient lengths, these bars were sold as merchant bars.

Although such bars were bought by blacksmiths, locksmiths, and even householders, they were most frequently sold to peddlers and merchants. The term "merchant bar" was originally applied to a piece of iron sold from a peddler's wagon or over a merchant's counter. An English pamphlet of the early 18th century defined this term as "such shaped iron as is usually imported by the merchant, about an inch and a half or two inches broad and one-third thick, and squares of



Courtesy "Steel Facts"

Map. 2. Geographical trend of iron industry, 1646-1857.

four-sided, hollow stone stack about 20 feet high, from 20 to 24 feet square at the base, and tapering to 16 to 20 feet square at the top. The interior egg-shaped cavity was lined with slate or other heat-resisting stone. The furnace was built against the side of a hill so that workmen could more easily charge it through the open top. They dumped in alternate layers of bog ore or magnetic ore, charcoal, and flux (oyster shells or limestone). The lime in the shells or stone formed a slag with the unwanted materials in the ore. Hot gases from the burning charcoal reduced the iron from the ore, and heat from the charcoal melted the metallic iron and fused the slag. As the charge of iron ore, charcoal, and flux descended in the furnace, droplets of iron and slag collected in two layers in the hearth or bottom of the furnace, the lighter slag floating on the heavier iron.

different sizes." The term later included bars of steel. In the 19th century rolling mills were developed to roll iron into merchant bar sizes. When larger mills were built to roll steel sections heavier than merchant bar sizes, the older mills that continued to roll the smaller sizes of bars were called merchant mills. Some sections of steel rolled for general resale purposes are still known as merchant bars.

While the molten iron from many colonial blast furnaces was cast or run directly into molds having the form of hollow ware, a large amount was also run into a main trough which led to smaller troughs. The solidified iron in the main trough was called sowe iron or sow iron, and that in the smaller troughs pig iron, from the analogy of a sow with suckling pigs. Both sowe iron and pig iron were commercial products of the colonial blast furnace. The term "pig iron" has been retained to designate a class of iron made in the modern blast furnace.

During the 131 years of the colonial iron industry, extending from 1644 to 1775, the principal consumers of iron and iron products were the householders, merchants, peddlers, ship chandlers, and metal craftsmen, such as gunsmiths, locksmiths, and blacksmiths, living in the vicinity of ironworks. Lack of cheap transportation localized the iron industry, and there were no important colonial industrial consumers of iron, although, when British laws and import taxes were favorable, considerable amounts of iron were exported to England. The first shipment of colonial bar iron to England was made in 1718 by the Principio Company from its Principio Furnace in Maryland (see Map 1). An import tax of £2 ls. 6d. per ton was levied on the 3.5 tons in the shipment. The Principio Company was one of the leading exporters of colonial iron. In 1750, for example, it shipped to England 2,050 tons of iron, an amount which represented two thirds of all colonial exports and one fifth of colonial iron production for that year.

The rapid growth of the colonial iron industry between 1715 and 1775 was not realized by the British Parliament, partly because reports from colonial governors were inadequate or incomplete, and partly because the colonists did not publicize the nature and extent of their industry. Furthermore, Great Britain itself was divided on the desirability of expanding the colonial iron industry. British ironmasters, fearing competition, argued for a high tariff on pig iron and bar iron imported from the colonies, while manufacturers of iron wares, seeking cheap raw material, argued for colonial bar iron.

When Sweden fought Denmark, Hannover, Prussia, Russia, and Saxony in 1717, shipments of Swedish iron to Great Britain were suspended. In the following year, when shipments were resumed, British manufacturers sought another source of iron and looked to North America. Their petitions to Parliament to increase the number of colonial ironworks started a long controversy that resulted in no parliamentary action until 1750. Meanwhile, the depression of British industries in 1735 closed many factories. The contemporaneous arrival of bar iron from Maryland, Pennsylvania, and Virginia aggravated the controversy when it was found by British navy yards' tests that colonial iron was equal to the best grade of Swedish iron—the world's finest at that time. To complicate the controversy, the colonists were accused of depriving British in-

dustries of an important market in North America because they manufactured iron articles from their own iron. Finally, after three decades of intermittent deliberation, Parliament enacted a law which provided that after June 24, 1750, "no mill or other engine for slitting or rolling iron, or any plating forge to work with a trip hammer, or any furnace for making steel" should be built in the American colonies. Works of these types already built were permitted to continue in operation. Enforcement of the law was the responsibility of colonial governors, who ordered the sheriffs to take a census in their respective counties in order to ascertain the status of the colonial industry. The census did not reveal the true status: the colonists did not cooperate, and the sheriffs were not sufficiently skilled in iron manufacture to identify what they saw in all cases. Census reports sent to the British Board of Trade indicated the following:

Connecticut—8 plating mills and 1 steel furnace
 Maryland—1 plating mill
 Massachusetts—2 slitting mills and 2 plating mills
 New Jersey—1 slitting mill, 1 plating mill, and 1 steel furnace
 New York—1 plating mill
 Pennsylvania—1 slitting mill, 1 plating mill, and 2 steel furnaces

It is estimated that by 1775 the American iron industry had outstripped its British counterpart, since the colonists had an estimated 80 blast furnaces with an average capacity equal to or slightly larger than that of the 60 English blast furnaces, and an estimated 175 forges, as compared with a total of 135 in England and Wales. While the estimated annual world output of iron rose from 150,000 tons¹ in 1750 to 210,000 tons in 1775, the estimated annual output of colonial iron rose from 10,000 to 30,000 tons. British regulations permitted the shipment of iron from the American colonies only to Great Britain or its colonies until 1765, when shipments to Ireland were also allowed. Nearly all of the American iron exported went to England; small amounts of pig iron and bar iron were sent to Scotland. Exports from the American colonies averaged 2,800 tons of pig iron and 570 tons of bar iron from 1730 to 1775. During this period the highest and lowest exports of pig iron were, respectively, 5,303 tons in 1771 and 1,725 tons in 1730; bar iron exports were at a maximum of 2,222 tons in 1771 and a minimum of 4 tons in 1748. Virginia and Maryland were important exporters of pig iron, and Pennsylvania of bar iron; New England, New York, and the Carolinas also exported iron prior to the revolution.

British parliamentary attempts to restrict the growth of the colonial iron industry were a minor but significant contributory cause of the War of Independence, since they united the majority of colonial ironworks owners and managers in support of the revolutionary movement. The following signers of the Declaration of Independence were associated with the iron industry: Charles Carroll of Carrollton, who, as a lawyer, was in close contact with Maryland's iron industry; Stephen Hopkins, who was part owner of the Hope Furnace, on the Pawtuxet River, Rhode Island, which made cannon and cannon balls during the revolution; Philip Livingston, who was the son of the owner of a bloomery on Ancram Creek, Columbia County, New York; George Ross, who was a partner of Mark Bird in building

¹ Presumably long tons of 2,240 pounds each.

the Mary Ann Furnace in West Manheim Township, York County, Pa., which cast shot and shell for the Continental Army; James Smith, who owned the Hellam Forge, later known as the Codorus Forge and Furnace, in York County, Pennsylvania; and George Taylor, who worked in his youth as a filler at Durham Furnace in Bucks County, Pennsylvania, and later became sole lessee of this property (Durham Furnace was another outstanding supplier of iron for the Continental Army). A score or more ironmasters and ironworkers, including Brig. Gen. Daniel Morgan, Maj. Gen. Nathanael Greene, and Col. Ethan Allen, served as officers under George Washington, whose father, Augustine Washington, was one of the owners of the Principio Company.

Colonial Steel Industry.—Very little steel was made in colonial America, and until the Bessemer process was used in the 1860's only a small amount of steel in comparison with iron was made in the United States. The colonists relied mainly on England for steel.

It is believed that Samuel Higley made the first colonial steel at Simsbury, Conn., between 1725 and 1728, and that he used the cementation process. The product of the cementation process was not uniform in chemical composition or in internal structure. Carbon was absorbed largely on the surface of the bar and only to a slight depth. The carbon content of the inner portion or core of the bar was much less than the maximum content of about 2 per cent carbon at the surface. The frequent presence of bands or threads of slag within the product also did not permit the steel to develop uniform properties. Blisters that formed on the surface gave this product the name of blister steel. In addition, it was expensive to make, since it required considerable equipment and time for a relatively small output. Yet it served the demand for a material stronger and harder than iron which could be made into edge tools and firearms.

The second steelworks appears to have been built in 1734 at Trenton, N. J., for the manufacture of edge tools. At least six other steelworks had been built in Massachusetts, Connecticut, New Jersey, and Pennsylvania by 1750, the date beyond which the British Parliament prohibited the erection of new steelworks, slitting mills, and plating mills in the American colonies. By 1776 steelworks had also been established in Rhode Island and New York.

United States Iron and Steel Industry, 1783-1864.—The significant developments in the iron and steel industry of the United States from 1783, when a rolling mill was built in Delaware, to 1864, when Bessemer steel was first made on a commercial scale, are listed in the following chronology:

- 1783—Rolling mill built near Wilmington, Del. It rolled Swedish and Russian iron to be made into cut nails by a New York factory.
- 1787—Era Furnace built in York County, S.C.
- 1788—Etna Furnace built in York County, S.C.
- 1790—Blue lump iron ore discovered in Fayette County, Pennsylvania, by John Hayden of Haydentown.
- 1790—Tennessee's first ironworks, a bloomery, built at Embreeville, Washington County.
- 1791—Kentucky's first blast furnace, known as the Bourbon Furnace or Slate Furnace, built by Jacob Meyer on Slate Creek, Bath County.
- 1794—Foundry cupola, a furnace for remelting pig iron to be cast into product form, patented by John Wilkinson.

- 1800—Iron mines opened in Lake Champlain district of New York. They provided ore for forges and furnaces subsequently erected in the district.
- 1801—Ironworks built at Willsboro Falls, Essex County, N.Y. by George Throop, Levi. Highly, and Charles Kane to make anchors, using Champlain ore.
- 1805—First successful foundry built in Pittsburgh, Pa., by Joseph McClurg, Joseph Smith, and John Gormley. Later known as McClurg's and McKnight's, it cast cannon, howitzers, balls, and shells used in the War of 1812 by Comdr. Oliver Hazard Perry on Lake Erie and by Gen. Andrew Jackson at New Orleans.
- 1806—Rolling mill built in Southfield, Delaware County, Pa.
- 1811—Pittsburgh Rolling Mill built in Pittsburgh, Pa.
- 1816—Wire fences made at White and Hazard Works, Chester County, Pennsylvania.
- 1816—Plumstock Works, first rolling mill to roll flat iron bars in the United States, erected in Fayette County, Pennsylvania, by Isaac Meason.
- 1818—Crucible steel plant built at Valley Forge, Pa., by James Wood, John Parkins, and John Parkins, Jr. See also entry for 1832.
- 1819—Bituminous coal first used in blast furnace experiment to make pig iron at Bear Furnace, Armstrong County, Pennsylvania.
- 1819—Coke first used in blast furnace experiment to make pig iron at Bear Furnace, Armstrong County, Pennsylvania. The furnace was built to use coke and cold blasts; steam-driven blast was too weak for successful operation. See also entries for 1834 and 1835.
- 1819—Angle iron allegedly first rolled in the United States by Samuel Leonard at the Union Rolling Mill, Pittsburgh, Pa.
- 1820—Boiler plates first rolled by Dr. Charles Lloyd Lukens at the Brandywine Rolling Mill, Coatesville, Pa.
- 1826—Malleable iron made by Seth Boyden at Newark, N.J.
- 1826—Wire netting made by Charles Barnard at Norwich, Conn.
- 1827—Anthracite coal, mixed with charcoal or coke, used in blast furnace experiment in Perry County, Pennsylvania, by Peter Rittner.
- 1827—Ohio's first blast furnace, Franklin Furnace, built in Green Township, Scioto County, by Daniel Young, John Young, Jesse Y. Whitcomb, Josiah Merrill, John Hurd, and Martin Ruter, all of New Hampshire.
- 1828—Scioto Furnace, a blast furnace, built on Frederick Creek, 11 miles east-northeast of Portsmouth, Ohio, by Gen. William Kendall.
- 1830—Terneplate (iron coated with an alloy of lead and tin) allegedly made at Philadelphia, Pa. (Actually, the large-scale manufacture of terneplate in the United States began only after the McKinley Act, q.v., became effective in July 1891.)
- 1830—T-rail invented by Robert Livingston Stevens, president of the Camden and Amboy Railroad, who also designed the hook-headed spike and other railroad track accessories. The first T-rails weighed 36 pounds per yard.
- 1830—Furnace for welding pipe, the first in the United States, built in Philadelphia, Pa., by Morris, Tasker & Morris.
- 1832—Crucible steel first made on a commercial scale in the United States at the Cincinnati (Ohio) Steel Works, owned by Dr. William Garrard and his brother. The steel, which was made from blister bar, was used to manufacture saws, axes, files, and the blades of the first McCormick reaper.
- 1832—Pinmaking machine invented by John Ireland Howe of Derby, Conn.
- 1833—Anthracite coal in combination with "strong blast, preferably heated," patented by Dr. Frederick W. Geissenhainer, a New York clergyman.
- 1834—Hot blast given first "practical application" in a United States blast furnace at Oxford Furnace, New Jersey, by William Henry.
- 1835—Coke first used successfully as a blast furnace fuel in Mary Ann Furnace, Huntingdon County, Pennsylvania, by William Firmstone.

- 1835—Horseshoe-manufacturing machine patented by Henry Burden of Troy, N.Y.
- 1839—Anthracite coal used successfully in a blast furnace by Benjamin Perry at Pioneer Furnace, Pottsville, Pa., and by David Thomas at Lehigh Crane Iron Company, Catasauqua, Pa.
- 1840—Rotary squeezer to remove slag from "puddled iron" (wrought iron) invented and patented by Henry Burden of Troy, N.Y.
- 1841—Wire rope first made in the United States by John A. Roebling at Saxonburg, Butler County, Pa.
- 1842—Recovery of unburnt blast furnace gas for burning under steam boilers first accomplished at Greenwood Furnace, Orange County, New York, in accordance with the method developed by Friedrich von Faber du Faur of Wasseraalengen, Germany.
- 1842—Connellsville coke, made in western Pennsylvania, delivered by barge to foundries in Cincinnati, Ohio.
- 1844—Lake Superior iron deposits first discovered by white men. The discovery was made on September 19 by William Austin Burt near the eastern end of Teal Lake in northern Michigan.
- 1844—Iron T-rails, weighing 50 pounds per yard, made at Mount Savage Rolling Mill, Allegany County, Maryland.
- 1845—First wrought iron T-rail rolled in the United States at the Montour Iron Works, Danville, Pa.
- 1845—Bituminous coal successfully used in a blast furnace in Mercer County, Pennsylvania, and at Lowellville, Mahoning County, Ohio.
- 1845—Howe-type truss railroad bridge built by Richard B. Osborne at Manayunk (now part of Philadelphia), Pa., with cast iron top chord and web braces and wrought iron bottom chord and vertical web members.
- 1846—Observation that iron in a finery fire was heated by the blast of air without the aid of charcoal made by William Kelly at the Suwanee Iron Works & Union Forge, Eddyville, Ky.
- 1847—Empire Furnace, a blast furnace, built in Vernon Township, Trumbull County, Ohio, by Jefferson W. and Obadiah Glidden.
- 1848—Arrival of Andrew Carnegie, his brother Thomas, and his parents in the United States from Dunfermline, Scotland.
- 1852—Blowing engines that increased output of pig iron from blast furnaces built by David Thomas of Catasauqua, Pa.
- 1852—Lake Superior ore first used in a blast furnace at Sharpsville, Mercer County, Pa.
- 1854—First wrought iron beams to be rolled in the United States for building construction produced by Peter Cooper, at Trenton, N.J.
- 1855—Sault Ste. Marie Canal, connecting Lake Superior and Lake Huron, built by Charles T. Harvey.
- 1855—30-foot rails rolled at Cambria Iron Works, Johnstown, Pa.
- 1857—Converter (Bessemer) process of steelmaking patented by William Kelly of Eddyville, Ky.
- 1857—Approximate date when press was first used to straighten rails.
- 1857—Continuous process of hardening and tempering music wire developed and patented by Ichabod Washburn of Worcester, Mass.
- 1857—Chicago Rolling Mill built by Capt. Eber B. Ward of Detroit in Chicago, Ill., to reroll iron rails.
- 1857—First Michigan iron ore railway completed from deposits on Marquette Iron Range to the port of Marquette on Lake Superior.
- 1857—Three-high rolling mill invented by John Fritz, chief engineer and general superintendent of the Cambria Iron Works, Johnstown, Pa.
- 1858—
- 1859—Tin plate (iron coated with tin) made by C. G. Hussey & Company, Pittsburgh, Pa. (Actually, the large-scale manufacture of tin plate in the United States began only after the McKinley Act, q.v., became effective in July 1891.)
- 1859—Zinc made in experimental furnace by Joseph Wharton, manager of the Lehigh Zinc Company, South Bethlehem (now part of Bethlehem), Pa. This marked the beginning of metallic zinc manufacture in the United States.
- 1859—
- 1860—Cold rolling of iron and steel invented and patented by Bernard Lauth, a partner of Benjamin Franklin Jones, founder of Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
- 1861—Approximate date when continuous annealing, cleaning, and galvanizing of wire (an English invention) was installed by Ichabod Washburn at the Washburn and Moen Works, Worcester, Mass.
- 1862—Wrought iron and steel columns, used for bridges and other structures, invented by Samuel J. Reeves of the Phoenix Iron Company, Phoenixville, Pa.
- 1864—Bessemer steel first made in the United States on a commercial scale by William Franklin Durfee, acting for the Kelly Pneumatic Process Company, Wyandotte, Mich.

Iron.—The westward and southward expansion of the iron industry, which began in the latter part of the colonial era, continued after 1783. By 1800, as shown on Map 2, ironworks were located in all of the original 13 states and also in Maine, Vermont, Tennessee, and Kentucky and in that part of Virginia which became West Virginia.

The arrival of the Industrial Revolution in the United States created new demands for iron in the manufacture of tools and machinery. The rapid rise of manufacturing in the northeastern part of the country in the early 19th century was a major factor in the basic shift in the national economy from agriculture to industry. Manufacturing in this area stimulated the expansion in capacity of existing ironworks and the erection of new works, particularly in Pennsylvania. Nevertheless, lack of cheap transportation continued to localize the manufacture of iron largely in areas near markets until the latter half of the 19th century. Even as late as 1857, when several thousand miles of railroads were in operation, iron products were readily available only to the 500 communities in which ironworks were located. The majority of these communities were in Pennsylvania, Virginia, Ohio, Tennessee, New York, and Kentucky, in which 690 blast furnaces had been built; the remaining furnaces were in Maine, New Hampshire, Vermont, Massachusetts, Connecticut, New Jersey, Delaware, Maryland, North Carolina, South Carolina, Georgia, Alabama, Indiana, Illinois, Michigan, Wisconsin, and Missouri.

The United States iron industry during the first half of the 19th century was characterized to a greater degree by expanded output than by improvements in technology, although many important technical advances were made, as indicated in the preceding chronology. At the beginning of this period charcoal was the only fuel successfully used in United States blast furnaces; at the end, charcoal, anthracite coal, bituminous coal, and coke were all employed.² Coke, hot blast, and blowing engines were important technical advances in increasing the efficiency of blast furnaces and consequently the output of pig iron. Rolling mills for bars, plates, and rails; the process of cold rolling iron; the continuous annealing, cleaning, and galvanizing of wire; and the making of wire rope were equally important developments in the manufacture of iron products.

The enormous increase in the annual output of pig iron was the outstanding achievement of this period of the iron industry. The estimated production of pig iron and bar iron totaled 30,000 tons³ in 1775 and 50,000 tons in 1800. In 1864 the production of pig iron alone totaled 1,135,996

² All of the 260 modern blast furnaces in the United States on Jan. 1, 1954, burned coke.

³ Presumably long tons of 2,240 pounds each.

net tons, of which 684,018 tons were made with anthracite coal, 241,853 tons with charcoal, and 210,125 tons with either bituminous coal or coke.

Two achievements in this period that made possible the industrial expansion of the latter half of the 19th century and its continuance through the first half of the 20th century were the discovery of the Lake Superior iron ore deposits and the building of the Soo (Sault Ste. Marie) Canal. A government surveyor, William Austin Burt, discovered the first of the Lake Superior deposits in northern Michigan in 1844, and a young scales salesman, Charles T. Harvey, envisioning Lake Superior ore in Eastern furnaces, organized and managed the company which completed the 5,700-foot Soo Canal in 1855 to connect Lake Superior and Lake Huron. Without the rich ores of the Lake Superior district and without cheap transportation to utilize them, it is doubtful if the United States would have attained its position as the leading industrial nation. A century after their discovery, the Lake Superior deposits were still among the richest and most extensive in the world, and through the two Soo canals more tonnage was transported annually than through any other canal.

Steel.—The manufacture of cemented steel, which was practiced during the colonial era, continued on a small scale during the first half of the 19th century. The output of cemented steel in 1810 was 917 long tons, as compared with 53,908 long tons of cast iron. By 1830 the annual capacity of the 14 steel furnaces in the United States totaled 1,600 tons. The introduction of the crucible process from England in 1832 did not lead to any considerable increase in steel production. The Compromise Tariff of 1833 closed the first crucible steel plant in Cincinnati, and the tariffs of 1846 and 1857 gave no encouragement to this steelmaking method. The full development of the crucible process occurred in the latter half of the 19th century.

Neither the cementation process nor the crucible process could make steel cheaply or in large amounts. The small quantities which were produced were used mainly in tools, instruments, small arms, and machine parts. While many articles were made of cast iron, its use in structures and machinery was limited because it was brittle and weak in tension. (The cast irons in modern use had not been developed.) Consequently, the further industrial development of the United States awaited a steelmaking method that could satisfy the mounting demand for a cheap structural material stronger than cast iron and bar iron.

The nearly simultaneous invention of the Bessemer process by Sir Henry Bessemer in England between 1854 and 1856 and of the Kelly pneumatic process by William Kelly in Kentucky between 1846 and 1857 provided such a steelmaking technique, now known as the Bessemer process. Each of the two inventors blew air through molten pig iron to burn the excess carbon and other elements, the burning supplying the heat required to keep the metal molten. Each had to rely on others for technical improvements to make the process commercially workable. Each was an outstanding pioneer to whom the industry and mankind are indebted.

The Bessemer process provided the cheap, strong steel that made possible the great expansion in the building of railroads and bridges, new types of textile, printing, and other machinery, steel ships, telegraph lines, agricultural imple-

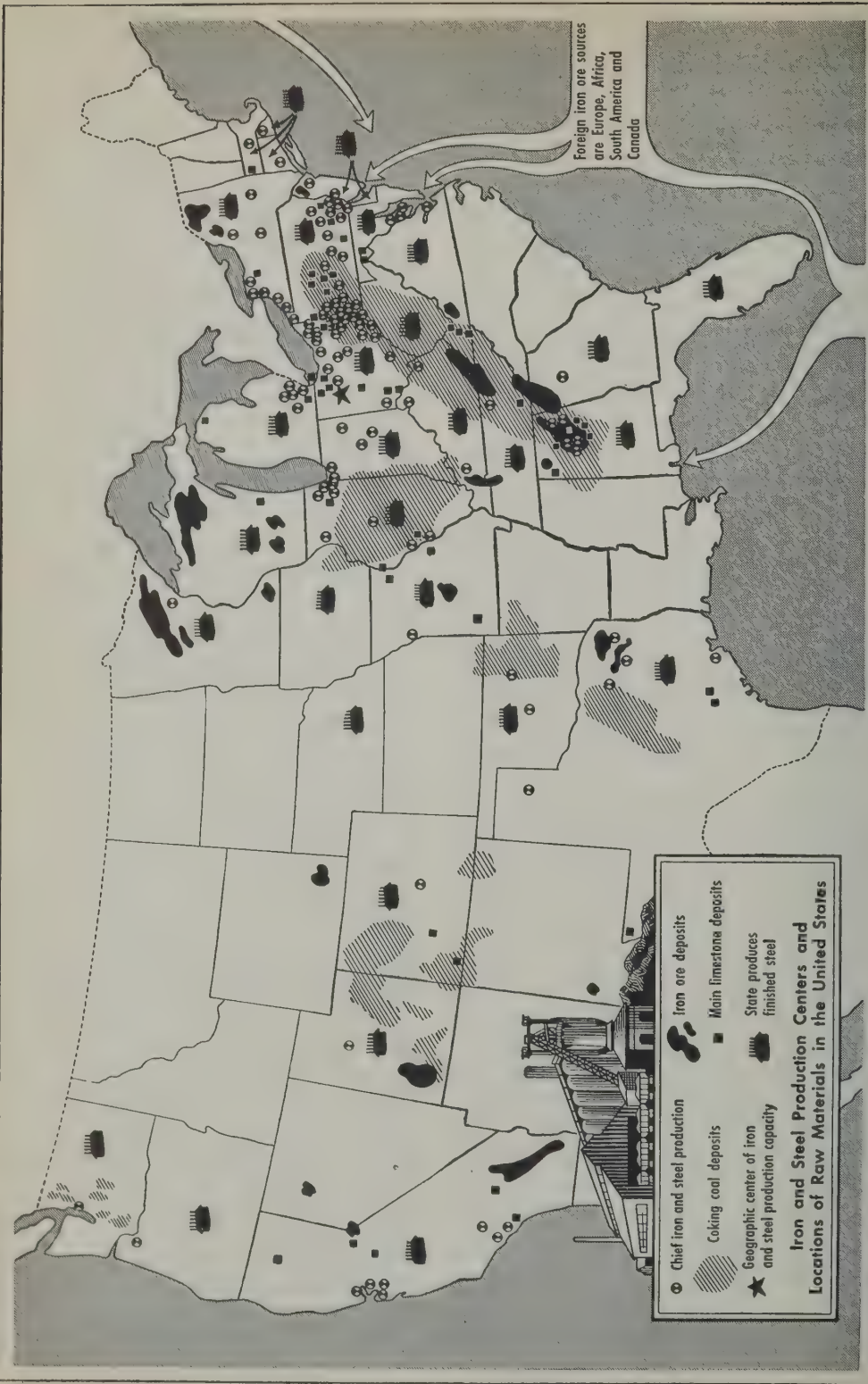
ments, pipelines, frameworks of buildings, and the electrical industry. At the same time, the widening demand for steel for small articles, ranging from bicycle spokes to safety pins, was also met by Bessemer steel. The flood of steel that poured from United States converters in the latter half of the 19th century began with the making of the first commercial heat of Bessemer steel in the country by William Franklin Durfee at Wyandotte, Mich., in 1864. The Bessemer process persisted as an important steelmaking method, despite the development of the open-hearth process in the latter part of the 19th century and the electric furnace process in the first decade of the 20th century.

United States Iron and Steel Industry Since 1865.—While United States iron and steel manufacture made notable technical advances after 1865, these were overshadowed by the consolidation of iron and steel plants into combinations of companies during the last quarter of the 19th and the first decade of the 20th centuries. Economies of operation resulting from consolidations generally resulted in lower prices of iron and steel. The extensive development of transportation by boat and rail favored the consolidation of many of the existing companies into organizations that owned ore, coal, and limestone deposits, railroads, and steamship companies, as well as completely integrated production units that controlled the quality of the product from the mine to the consumer.

Technological Progress.—The United States iron and steel industry grew rapidly after 1865 because it helped the growth of so many other industries, among them the railroad, petroleum, electrical, farm equipment, automobile, and machine tool industries. The development of each of them required more useful iron and steel products, new types of iron and steel, and lower iron and steel costs.

New methods of working steel kept pace with new steelmaking methods. Technological development followed two paths, one mechanical and the other metallurgical. Methods of hot rolling steel into a variety of semifinished products, which in turn were rolled into rails, structural shapes, and pipe, were put on an automatic basis. Knowledge acquired about the internal structure of steel permitted the development of continuous rolling mills to reduce steel to paper thickness. Hand methods of drawing wire were replaced by automatic processes that drew the many sizes and kinds of wire required by such diverse products as cables for suspension bridges and springs for typewriters. Methods of coating steel with cadmium, copper, lead, tin, and zinc were improved and mechanized, and the quality of the coatings was made more uniform. The development of methods of welding steel led to significant changes in the design of many products in which steel assemblies were used.

The development of the open hearth and electric furnace for steelmaking required improved metallurgical and mechanical techniques. These in turn required better furnace refractories, more efficient methods of burning fuels, and sensitive, automatic devices for measuring temperature and controlling chemical reactions in steelmaking and iron manufacture. The microscope opened the way to a better appreciation of the complex nature of commercial irons and steels, and resulted in the rapid development of methods of heat treating iron and steel to enhance their properties. This line of investigation also led to the creation of a



Map 3.

series of alloy steels and alloy irons containing elements added in order to obtain properties not present in conventional plain carbon steels or cast irons, such as an extreme resistance to corrosion, elevated temperature, and repeated stressing.

One outstanding development problem concerned the beneficiation or enrichment of the lower grades of iron ore in the United States. The Lake Superior iron ore district, embracing the iron ranges in Minnesota, Wisconsin, and Michigan, produced 85 per cent of the ore consumed by the United States. The life of the high-grade deposits in these ranges was estimated in 1945 to be 20 years; and the known reserves containing over 50 per cent metallic iron were estimated at 500,000,000 long tons. From 1941 through 1945 the United States produced 482,055,313 long tons of iron ore, of which 409,834,624 long tons came from the Lake Superior district. Tremendous deposits in the district containing 30 to 50 per cent iron were also worked. Ores from some of these deposits were blended with the high-grade ores, and others were beneficiated or concentrated by mechanical methods. But the cost of such beneficiation increased with the leanness of the ore. In 1945 there were also estimated to be 60 billion long tons of taconite in the Lake Superior district. Taconite is a general term applied to several iron mineral formations containing 20 to 35 per cent iron. The Minnesota deposits are estimated to contain 27 billion tons, much of which has an iron content of 30 to 35 per cent. These deposits are too lean for direct smelting in United States blast furnaces.

Beginning in 1942 research was intensified to develop processes to beneficiate or concentrate the iron minerals in the low-grade deposits. In 1948 research on some of the taconite deposits of Minnesota materialized in the operation of a pilot plant at Aurora, Minn., to produce 200,000 tons of concentrates annually. By 1954 this operation had yielded sufficient information to warrant beginning construction of a 10,500,000-ton plant near Aurora. Similarly, a plant with a capacity of 300,000 tons at Babbitt, Minn., was the basis of a plant completed in 1955 at Silver Bay, Minn. Other new plants for concentrating low-grade iron deposits, in operation or scheduled for construction, were located at Mountain Iron and Virginia, Minn., and Ishpeming and Humboldt, Mich. When all of these plants were operating at full capacity, the output of iron mineral concentrates was expected to total about 21,400,000 tons annually.

Production.—The location of the principal iron and steel producing centers and sources of raw materials in the United States as of 1954 are shown on Map 3. From 1941 through 1953 the national production of crude steel totaled about 1,152 million tons, or more than the output of the 26-year period of 1915 through 1940. This accelerated production so depleted the high-grade iron ore within the United States that worldwide exploration for new sources of ore was undertaken after World War II and was continued in the 1950's. In 1954 iron ore from every continent except Antarctica and Australia was smelted in United States blast furnaces to produce pig iron or charged into steelmaking furnaces, the imported ore totaling 15,782,530 net tons. The supplying countries, listed in the order of the amount of ore imported from each, were Venezuela, Canada, Peru, Chile, Sweden, Liberia, Brazil, British West Africa, Mexico, Dominican Republic, Cuba, Algeria, Iran, Great Britain, and Spain.

The magnitude of the demand for iron ore is evident from a few statistics on the production of iron and steel. Nearly 2 tons of iron ore containing a minimum of 50 per cent iron are required to produce 1 ton of pig iron, the small balance of the required iron being supplied by scrap. During the month of March 1953, 6,601,113 net tons of standard grades of pig iron were produced by blast furnaces in the United States. In the same month most of the pig iron, together with approximately equal amounts of scrap iron and steel and a small amount of iron ore, was charged into steelmaking furnaces to produce 10,168,000 net tons of crude steel. That monthly output of steel was equivalent to about 7,500,000 tons of finished steel products, or enough to provide steel for all of the following: 2 million automobiles; 1 million kitchen stoves; 1 million household refrigerators; 1 million washing machines; 10,000 railroad box cars; all the steel shipped directly from steel mills in 1952 for ordnance and other military purposes, aircraft, oil and gas drilling, mining, quarrying, and lumbering; cutlery and utensils for 8 million kitchens; and a small amount of steel for other purposes.

CANADA

Development of the Iron Industry.—The St. Maurice Forges, erected in 1737 three miles west of Three Rivers (Trois-Rivières), Quebec, were the first ironworks in Canada. They comprised a blast furnace and, by 1747, two "great forges" and two "lesser ones," which were built by Cugnet et Cie with the aid of a royal license and 10,000 livres from King Louis XV of France. The blast furnace was rebuilt in 1743 and modified between 1793 and 1809. By 1880 it was 30 feet high and had internal diameters of 2½ feet at the hearth, 7 feet at the bosh, and 3½ feet at the throat. Two tuyères supplied a blast of cold air to burn charcoal obtained from local trees, and local ore and limestone were smelted to produce 4 tons of pig iron daily. When the exhaustion of local ore and fuel finally shut down the blast furnace in 1883, it had earned the designation of the oldest active furnace in North America.

Another important ironworks was built about 1860 by Messrs. Larue & Co. at Radnor Forges, Champlain County, Quebec, a site which coincided with one chosen in 1672 by Louis de Buade, comte de Frontenac, as the most desirable location for a blast furnace in the St. Maurice district. The same company constructed a foundry at Three Rivers. The blast furnace originally produced 4 tons of pig iron daily; in 1892 a new blast furnace began operation at the rate of 24 tons daily. The foundry made cast iron wheels for railroad cars, and a pair of these wheels that had run 150,000 miles was displayed at the international exhibition held in London in 1862. Radnor Forges continued to make iron intermittently until 1911, when the exhaustion of suitable ores closed the ironworks.

The date of erection, location, type of works, and products of these and other early Canadian ironworks are listed in the following chronology:

- 1737—Three miles west of Three Rivers, St. Maurice County, Quebec; blast furnace and four forges, all known as St. Maurice Forges; pig iron, castings such as cannons, mortars, shot, pots, kettles, and stove parts, and bar iron.
- 1798—East bank of Batiscan River, Champlain County, Quebec; blast furnace and two forges; pig iron, castings, and bar iron.

- 1800—Lyndhurst (formerly Furnace Falls), on Gananoque River, Leeds County, Ontario; blast furnace and forges; pots, kettles, and bar iron.
- 1821—Normandale (formerly Potter's Creek), Norfolk County, Ontario; blast furnace; stove parts and kettles.
- 1825—Clementsport, Annapolis County, Nova Scotia; blast furnace; pig iron.
- 1830—Marmora, Hastings County, Ontario; blast furnace; pig iron.
- 1837—Marmora, Hastings County, Ontario; a second blast furnace erected to make pig iron for conversion into bar iron.
- 1848—Woodstock, Carleton County, New Brunswick; blast furnace; pig iron.
- 1850—Londonderry, Colchester County, Nova Scotia; forge; bar iron.
- 1854—Houghton, Norfolk County, Ontario; blast furnace; pig iron.
- 1856—Nictaux Falls, Annapolis County, Nova Scotia; two blast furnaces; pig iron.
- 1857—Montreal, Quebec; rolling mills; iron sheets, hoops, and nails.
- 1857—Hull, Hull County, Quebec; blast furnace; pig iron.
- 1860—Radnor Forges, Champlain County, Quebec; blast furnace, forge, and rolling mill; pig iron, wrought iron for the manufacture of railroad car axles, scythes, and nail rod iron.
- 1860—Three Rivers, St. Maurice County, Quebec; foundry; cast iron wheels for railroad cars.
- 1860—Bloomfield, Digby County, Nova Scotia; blast furnace; pig iron.
- 1860—Toronto, Ontario; rolling mills, rerolled iron rail products.

Many of the early ironworks depended on local ore and wood for charcoal, and they closed when these were depleted. Although some skilled labor was available, ready access to farm lands made the workers independent of industry, and operations were sometimes curtailed by labor shortages. Moreover, the lack of cheap transportation restricted the availability of ore and fuel and markets for the products of the ironworks, and competition with foreign products and business depressions hampered profitable operations. By 1896 only six blast furnaces produced pig iron in Canada: one in Hamilton, Ontario, with a daily capacity of 200 net tons; one in Ferrona, Nova Scotia, 125 net tons; one in Londonderry, Nova Scotia, 100 net tons; one in Radnor Forges, Quebec, 25 net tons; and two in Drummondville, Quebec, 7 and 8 net tons, respectively.

Thereafter the number of blast furnaces increased as the construction of steel plants provided a demand for pig iron to be refined into steel, and as Canada's expanding industrial needs required greater quantities of pig iron for remelting in foundries making cast iron products. The annual capacity of Canadian blast furnaces in 1952 is shown in Table 2.

Table 2—ANNUAL CAPACITY OF BLAST FURNACES IN CANADA, 1952

Company and location	Number of furnaces	Annual capacity (net tons)
Algoma Steel Corporation, Limited, Sault Ste. Marie, Ontario	5	1,058,000
Canadian Furnace Company, Limited, Port Colborne, Ontario	2	223,000
Dominion Foundries and Steel Limited, Hamilton, Ontario	1	320,000
Dominion Iron & Steel Limited, Sydney, Nova Scotia	3	595,000
Steel Company of Canada, Limited, Hamilton, Ontario	4	1,250,000
Total	15	3,446,000

The output of Canadian pig iron rose from about 96,000 tons in 1900 to about 920,000 tons in 1911. In 1954 production of pig iron totaled 2,317,839 tons.

Development of the Steel Industry.—By 1879 imported mild steel was replacing wrought iron in Canada for some products, particularly axles for railroad cars. The shortage of wrought iron and scrap iron as raw materials for the works of the Nova Scotia Forge Company, combined with the prospect of using pig iron and imported scrap steel as raw materials for the Siemens-Martin open-hearth process then being developed in France and Great Britain, led to the formation of a new company, the Nova Scotia Steel Company, in 1882. In the following year, at its works in Trenton, Nova Scotia, steel was successfully manufactured on a commercial scale for the first time in Canada. The old company forged steel ingots purchased from the new company, for which it also provided maintenance parts and service. This interdependence resulted in the combination of the two as the Nova Scotia Steel and Forge Company, which produced steel for agricultural implements, steel angles, flats, special sections, and squares, rivet steel, railway fish-plates, plow plates, nail plate, and rails. In 1892 the New Glasgow Coal, Iron and Railway Company erected a blast furnace at New Glasgow, Nova Scotia. About one half of its pig iron output was supplied to the Nova Scotia Steel and Forge Company, and in 1895 the two companies were combined under the name of the original steel producer, Nova Scotia Steel Company.

One of the four principal segments of the Canadian steel industry was founded at Sydney, Nova Scotia, in 1899, following the loss of the New England coal market by the Dominion Coal Company. Both geographical and economic factors favored Sydney as a site for a steel plant. Cape Breton coal and Newfoundland iron ore and limestone were readily accessible to Sydney's harbor during the eight ice-free months, and a grant of land on the harbor and exemption from local taxation for 20 years were offered to induce selection of the city. Moreover, Canada's demand for steel was growing, and Sydney products could also easily be shipped to European markets. Of more immediate concern was the finding of a market for the Dominion Coal Company's Cape Breton coal. A stockholder of that company, Henry M. Whitney of Boston, proposed the construction of a steel plant as a market for the coal. This proposal resulted in the formation of the Dominion Iron and Steel Company and the eventual erection of coke ovens, blast furnaces, open-hearth furnaces, a blooming mill, a rail and billet mill, a bar and rod mill, and wire and nail mills. In the 1950's the Sydney steel plant and additions to it were operated by the Dominion Steel & Coal Corporation, Limited. The Sydney plant used iron ore from the Wabana mines on Bell Island, Newfoundland, limestone from deposits at Port au Port, Newfoundland, and coal from the Sydney coal field, 13 miles distant from the plant, and from two other Nova Scotian fields, the Cumberland field near Springhill and the Pictou field near New Glasgow.

While the steel industry was developing in Nova Scotia, a similar development took place in Ontario. In 1883 the London Steelworks Company of London, Ontario, built a 30-ton Siemens open-hearth furnace and a rolling mill to produce steel castings, car wheels, steel round

bars and flat bars, and steel coil springs. A puddling furnace and steam hammers were added in the following year. In 1893 the city of Hamilton offered a free site and a bonus of \$40,000 to any company which would spend \$400,000 in building a smelting works with a daily capacity of 150 tons before Dec. 31, 1894, and an additional bonus of \$60,000 if the company would erect a steel plant by Dec. 31, 1896. The time limit was subsequently extended by the city. The offer was accepted by the Hamilton Blast Furnace Company, which completed a blast furnace at Hamilton in 1895 and a steel plant, puddling furnaces, and a spike factory in 1897. The use of Lake Superior ore, after other ores had been found to be unsuitable, was an important factor in the success of this company.

Both of these companies were components of the Hamilton Steel and Iron Company, Limited, which in turn was one of the five companies which merged in 1910 to form the Steel Company of Canada, Limited, the second of the major components of the Canadian steel industry. The other four companies in the merger were the Montreal Rolling Mills Company, the Canada Screw Company, Limited, the Dominion Wire Manufacturing Company, Limited, and the Canada Bolt and Nut Company, Limited. Each of the five companies which combined to form the Steel Company of Canada, Limited, had in turn resulted from the merging of a number of producers and manufacturers of iron and steel. Some of these subsidiary or predecessor companies, with their dates of incorporation and typical products, are listed as follows under the five companies:

<i>Hamilton Steel and Iron Company, Limited, Hamilton, Ontario (1910):</i>	Bar iron, iron fishplates, bolts, spikes, steel bars
<i>Ontario Rolling Mills Co., Swansea, Ontario (1861)</i>	Iron bars, nail plate, iron products from rerolled rails
<i>Hamilton Iron & Forging Co., Hamilton, Ontario (1880)</i>	
<i>Hamilton Blast Furnace Company, Hamilton, Ontario (1895)</i>	Pig iron for foundries
<i>Windemere Rolling Mills, Toronto, Ontario</i>	
<i>London Steelworks Company, London, Ontario (1895)</i>	Steel castings, bar steel, bar iron
<i>American Nail Works</i>	Iron nails
<i>Montreal Rolling Mills Company, Montreal, Quebec (1868):</i>	Cut nails, wire nails, tacks, pipe, tubing
<i>Hodgson Iron and Tube Co., Montreal, Quebec (1902)</i>	Butt-welded tubing
<i>J. & C. Hodgson, St. Henri, Quebec (1888)</i>	Butt-welded tubing
<i>Pillow-Hersey Mfg. Co., Ltd., Montreal, Quebec (1887)</i>	Iron bars for bolts and nuts, cut nails, spikes, horse-shoe nails
<i>Pillow & Hersey Co., Montreal, Quebec (1876)</i>	Plate for cut nails, bars, bolt and nut stock, nails, carriage bolts, felly plates for wheel manufacture
<i>John Bigelow, Montreal, Quebec (1849)</i>	Cut nails
<i>Canada Screw Company, Limited, Hamilton, Ontario (1866):</i>	Screws, tacks
<i>Ontario Tack Co., Hamilton, Ontario (1885)</i>	Tacks, wire, nails
<i>Western Wire & Nail Co. Peerless Wire Co.</i>	Fine wire, coppered wire
<i>Dominion Wire Manufacturing Company, Limited, Lachine, Quebec (1883):</i>	Wire, galvanized wire, wire rope, nails, screws
<i>Dominion Barb Wire Company, Limited, Montreal, Quebec</i>	Galvanized barbed wire, wire rope

<i>Canada Bolt and Nut Company, Limited, Toronto, Ontario (1919):</i>	Bolts, nuts
<i>Gananoque Bolt Co. (1905)</i>	Bolts, nuts
<i>Toronto Bolt & Forging Co. (1900), Gananoque and Swansea, Ontario</i>	
<i>MacDonell Rolling Mills Co., Sunnyside, Ontario</i>	
<i>Geo. Gillies Company, Limited (1893), Gananoque, Ontario</i>	
<i>Geo. Gillies, Reg'd (1874), Gananoque, Ontario</i>	Harrows, cultivators, bolts, nuts
<i>Top Lifting Co., St. Catharines, Ontario</i>	Bow sockets, top joints, buggy rails
<i>Byers & Matthews, Gananoque, Ontario</i>	Fifth wheels
<i>R. P. Colton</i>	
<i>Swansea Forging Co. (1895), Swansea, Ontario</i>	Farm implements
<i>Ontario Bolt & Forge Co. (1891), Swansea, Ontario</i>	
<i>Dundas Horseshoe & Drop Forging Co., Dundas, Ontario</i>	
<i>Ontario Bolt & Iron Co. (1885)</i>	
<i>Lillie Bolt & Nut Co., Perth, Ontario</i>	
<i>Dominion Bolt & Iron Co. (1893), Swansea, Ontario</i>	Bolts, nuts, spikes, rivets
<i>Dominion Bolt & Nut Co. (1880), Toronto, Ontario</i>	Bolts
<i>Dominion Bolt Works (1879), Toronto, Ontario</i>	Track bolts and spikes, nuts, tire and stove bolts, rivets, bridge rods
<i>Canadian Bolt Co. (1868), Perth and Toronto, Ontario</i>	Bolts, nuts
<i>Brantford Screw Company (1901), Brantford, Ontario</i>	Bolts, nuts, rivets, screws
<i>Chalcraft Screw Co. (1898)</i>	
<i>Belleville Iron & Horse-shoe Co. (1907), Belleville, Ontario</i>	Horseshoes, spikes
<i>Toronto & Belleville Rolling Mills Co. (1906), Belleville, Ontario</i>	
<i>T. M. Kirkwood Company, Belleville, Ontario</i>	
<i>Iron & Steel Co. of Canada, Belleville, Ontario</i>	
<i>Abbott-Mitchell Iron & Steel Co. (1898), Belleville, Ontario</i>	Spikes, nails
<i>Metropolitan Rolling Mills (1883), Montreal, Quebec</i>	

The search for a market for water power led to the establishment of another important Canadian iron and steel center, at Sault Ste. Marie, Ontario. In 1894 the town of Sault Ste. Marie sold its power canal and powerhouse to Francis Hector Clergue and E. V. Douglas. The Lake Superior Power Company, which was organized to market the power, built a wood pulp and paper mill and acquired a pyrrhotite mine as a source of the sulphur needed in the manufacture of pulp. After the sulphur was removed from the pyrrhotite ore, the residue could be smelted to yield an iron containing about 7 per cent nickel. Since there was then no market for such iron, the nickel content had to be reduced. This was done by smelting the residue with iron ore obtained from the Helen mine near Jamestown in the Michipicoten area of northern Ontario.

Several companies participated in the development of the iron and steel industry at Sault Ste. Marie. In 1899 the Consolidated Lake Superior Company was formed to acquire and develop further the local water power and to

operate the Helen mine. A subsidiary company, the Algoma Steel Company, was formed in 1901 to manufacture coke, iron, steel, and steel products. This company built and operated a steel plant which produced steel rails in 1902 before the erection of coke ovens and a blast furnace had been completed at Sault Ste. Marie. The plant contained two 5-ton Bessemer converters with a combined steelmaking capacity of 600 tons a day, a 32-inch blooming mill, and a 23-inch rail mill. On May 5, 1902, the rail mill rolled Canada's first standard rail. In the same year the Algoma Tube Works was incorporated to manufacture tubes, and the steel plant was closed. During 1903 a new company, the Lake Superior Corporation, succeeded the Consolidated Lake Superior Company. It completed its first blast furnace at Sault Ste. Marie in the following year. Before the furnace began operating, it was found that the ore from the Helen mine could yield pig iron more suitable for refining in open-hearth furnaces than in Bessemer converters, and two open-hearth furnaces were therefore installed. Plant facilities were expanded with the construction of new coke ovens in 1906 and 1907 and a second blast furnace in 1908. The entire steel output was in the form of rails, of which 126,775 tons were produced in 1908. In the following year the company began a plant expansion program, including coke ovens, rolling mills, and equipment for making railroad track accessories. The Algoma Steel Corporation, Limited, the third of the leading Canadian iron and steel producers, succeeded the Algoma Steel Company in 1912.

Dominion Foundries and Steel Limited, the fourth principal iron and steel producer, was organized in 1917. Its works in Hamilton, Ontario, produced mainly wrought steel products and steel castings until 1951, when a coke oven plant and a blast furnace began operating.

The Canadian steel industry grew gradually until 1939. From then until Dec. 31, 1952, annual crude steel capacity rose 129 per cent, from 2,094,500 to 4,784,100 tons, and of this capacity, 1,500,000 tons were added in 1950-1952. Annual

Table 3—ANNUAL CAPACITY OF STEEL FURNACES IN CANADA, DEC. 31, 1952

Type of furnace	Number of furnaces	Annual capacity (net tons)
Basic open-hearth	48	3,808,900
Electric	77	970,400
Converter	2	4,800
Total	127	4,784,100
Kind of product		
Steel ingots (basic open-hearth)		3,757,300
Steel ingots (electric furnace)		714,400
Steel castings		312,400
Total		4,784,100
Province		
Alberta		2,500
British Columbia		65,825
Manitoba		66,700
Nova Scotia		716,000
Ontario		3,642,975
Quebec		290,100
Total		4,784,100

Table 4—STEEL FURNACES IN CANADA, DEC. 31, 1952

(E = electric furnace; C = converter; O = open-hearth)

Company	Type	Number of units	Annual capacity (net tons)
<i>Alberta:</i>			
Foothills Steel Foundry and Iron Works, Calgary	E	1	1,200
Riverside Iron & Engineering Works, Ltd., Calgary	E	1	1,300
<i>British Columbia:</i>			
A-1 Steel and Iron Foundry, Vancouver	E	1	1,900
Britannia Mining and Smelting Co., Ltd., Britannia Beach	E	1	4,200
Consolidated Mining and Smelting Co. of Canada, Trail	E	2	8,500
Reliance Foundry Co., Ltd., Vancouver	E	2	5,000
Vancouver Engineering Works, Ltd., Vancouver	E	2	5,500
	C	1	4,500
Vancouver Steel Co., Ltd., Vancouver	E	1	35,000
Victoria Machinery Depot Co., Ltd., Victoria	E	1	625
Canadian Summer Iron Works, Ltd., Vancouver	E	1	600
<i>Manitoba:</i>			
Manitoba Rolling Mill Co., Ltd., Selkirk	O	2	40,000
	E	1	20,000
Manitoba Steel Foundries, Selkirk	E	1	4,000
Vulcan Iron Works, Ltd., Winnipeg	E	1	2,700
<i>Nova Scotia:</i>			
Dominion Iron & Steel Limited, Sydney	O	10	685,000
	E	1	28,000
Maritime Steel Foundries, Ltd., New Glasgow	E	1	3,000
<i>Ontario:</i>			
Algoma Steel Corporation, Limited, Sault Ste. Marie	O	12	820,000
Atlas Steels, Limited, Welland	E	6	169,600
Burlington Steel Co., Ltd., Hamilton	E	1	26,000
Canada Electric Castings, Ltd., Orillia	E	2	6,000
Dominion Foundries and Steel Limited, Hamilton	O	4	253,200
	E	5	175,400
Fahrloy Canada, Ltd., Orillia	E	3	6,900
Ford Motor Company of Canada, Ltd., Windsor	E	18	99,975
Steel Company of Canada, Limited, Hamilton	O	17	1,859,100
	E	1	110,000
Welland Electric Steel Foundry, Ltd., Welland	E	3	5,400
William Kennedy and Sons, Ltd., Owen Sound	E	2	11,400
<i>Quebec:</i>			
Canadian Car and Foundry Co., Ltd., Montreal	O	3	51,600
	E	3	13,700
Canadian Tube and Steel Products, Montreal	E	2	120,000
Canadian Unitcast Steel, Ltd., Montreal	E	1	12,000
Dominion Brake Shoe Company, Ltd., Joliette	E	2	12,000
Dominion Engineering Works, Ltd., Lachine	E	1	5,000
La Compagnie F. X. Drolet, Ltd., Quebec	C	1	300
Lynn MacLeod Metallurgy, Ltd., Theftford Mines	E	1	2,000
Manganese Steel Castings, Ltd., Sherbrooke	E	1	1,800
Shawinigan Chemicals, Ltd., Shawinigan Falls	E	3	6,300
Sorel Industries, Ltd., Sorel	E	3	60,400
Sorel Steel Foundries, Ltd., Sorel	E	1	5,000

capacity by type of furnace, kind of product, and province on Dec. 31, 1952, is shown in Table 3, and that of the various Canadian steel companies in Table 4.

Total Canadian steel output increased from about 27,000 tons in 1900 to about 970,000 tons in 1911, and to 3,157,867 tons in 1954. (In 1953 a record 4,103,914 tons of raw steel were produced.) Basic data on the primary iron and steel industry as of 1952 are given in Table 5.

Table 5—PRIMARY IRON AND STEEL INDUSTRY IN CANADA, 1952

Province	Number of plants	Number of employees	Salaries and wages (\$000)	Cost of materials at plants (\$000)	Gross selling value of products at plants (\$000)
Alberta	2	642	2,180	1,876	6,318
British Columbia	9				
Manitoba	4	1,058	3,385	3,208	9,835
Nova Scotia	5				
Ontario	24	23,479	87,661	189,474	386,834
Quebec	14	4,503	15,359	21,977	60,537
Total	58	35,001	124,387	239,001	504,002

The rapid growth of the Canadian steel industry has been tempered by the belief that Canada should produce most but not all of its iron and steel requirements. On May 8, 1953, Defense Production Minister Clarence D. Howe stated that Canada then consumed about 5,500,000 tons of steel annually. Concerning the capacity added during 1950–1952, he remarked: "I understand the steel mills would want to absorb that capacity before they move on to another general increase." He concluded: "We have never supplied our full capacity and I do not know it is advisable to do so. It is just as well to have a margin that we import in good times, and do not require to import in poor times—just a little cushion for our

Table 6—CANADIAN IRON ORE DEPOSITS

Deposit and location	Probable magnitude (in net tons)
Quebec-Labrador; a group of deposits between Knob Lake and Lake Ashuanipi on either side of the border between Quebec and Labrador	500,000,000
Ungava; northern Labrador near Ungava Bay, Quebec	566,000,000
Steep Rock Lake; Ontario	100,000,000
Algoma District; North of Sault Ste. Marie, Ontario	300,000,000
Marmora; Ontario	1
Simcoe; near Lake Erie, Ontario	1
Wabana; Bell Island, Newfoundland	3,500,000,000
Quinsam Lake; Vancouver Island, British Columbia	2,000,000
Mayo District; Yukon Territory	8
Lake Tio; near Lake Allard, Quebec	4
Sudbury; Ontario	5

¹ The probable magnitude of these and other incompletely developed deposits in Ontario is 200,000,000 tons. ² In 1952 ore conveyers were installed to increase the annual output of this deposit to 2,800,000 tons. ³ An extensive deposit reported in 1951. ⁴ An ilmenite deposit with a probable magnitude of 100,000,000 tons. ⁵ A nickel-bearing pyrrhotite deposit. A process was developed in 1953 to recover 1,000,000 tons of iron minerals annually from pyrrhotite residue remaining after removal of the nickel.

steel industry when it has a rather restricted market."

Iron Ore.—The depletion of high-grade iron ore deposits in the United States led to a search for additional deposits in Canada following World War II. By 1953 two large deposits, Quebec-Labrador and Ungava, were under development. The first large-scale shipment of iron ore from the Ungava deposit, 20,000 tons, arrived by boat at Philadelphia on Aug. 5, 1954. A third deposit, Steep Rock Lake, already producing, was being further developed. It is estimated that these deposits contain a total of more than 1 billion tons of high-grade ore, and that each of them may contain at least 1 billion tons of usable ore. These and others are listed in Table 6. In 1954 a total of 7,280,256 tons of iron ore was shipped from Canadian mines.

MEXICO

The Mexican iron and steel industry might have begun soon after the discovery in 1552 of Cerro de Mercado, the country's so-called iron mountain near Durango, but the Spaniards' successful searches for gold and silver postponed the founding of the industry until the 19th century. Lacking a growing iron and steel industry when the Industrial Revolution began in the 18th century, Mexico remained an importer of iron and steel while other countries, poorer in precious metals, used their industry to provide tools, machinery, equipment, and transportation for industrial expansion. Only during the 20th century has the industry attained significant development in Mexico.

It is estimated that the gold and silver mined in Mexico during the period 1521–1945 amounted to \$3,855 million. In the same period only 1,936,000 tons of iron, 40,667,000 tons of coal, and 35,000 tons of manganese, having a total value of \$149 million, were produced. Had even a small fraction of the gold and silver produced in the 17th and 18th centuries been used to establish an iron and steel industry, Mexico might have become an important industrial nation during the 19th century. In the 20th century the Mexican government has encouraged the development of the industry by waiving duties on imported equipment, granting tax exemptions to Mexican iron and steel producers, and taxing imported semifinished and finished steel products.

Cerro de Mercado Ore.—The ore in Cerro de Mercado is principally hematite, with some martite, magnetite, and limonite. Estimates of the amount of iron ore in the mountain range from 76 million to 200 million tons. The first attempt to use this ore was made in 1828, when a small amount was mined. In 1882 a foundry was built near the base of the mountain by the Iron Mountain Company, which had been organized in the previous year. Ownership of the deposit was transferred successively to the Mexican Iron Mountain Manufacturing Company, the Durango Steel & Iron Company, and, in 1920, to the Compañía Fundidora de Fierro y Acero de Monterrey, S. A., which mined it until 1934. Thereafter, a subsidiary company, Cerro de Mercado, S. A., continued to develop the deposit. From 1920 to 1944 about 2 million tons of iron ore, with an average analysis of 62.0 per cent iron, 3.5 per cent silicon, 0.5 per cent phosphorus, and 0.5 per cent sulphur, were produced from the deposit. Most of this ore was shipped to the parent company's plant at Monterrey.

Steel Production.—Large-scale steel production began in Mexico in 1903 at the Monterrey plant of the Compañía Fundidora de Fierro y Acero de Monterrey, S. A., which had been organized in 1900. By 1953 the company had an annual capacity of 290,000 tons of pig iron and 200,000 tons of crude steel. During 1951 it produced 117,900 tons of finished steel products: rails, joint bars, bars, structural shapes, wire, nails, screws, nuts, and other products.

The second principal producer, Altos Hornos de México, S. A., which was organized in 1942, built a plant at Monclova, Coahuila, and began production in 1944. Its 1951 output of 117,300 tons of finished steel products consisted mainly of tin plate, sheet, plate, and welded pipe. During 1953 construction of an 800-ton-per-day blast furnace was begun. Other Mexican producers and their plant locations are the Compañía de Acero y Maquinaria La Consolidada, S. A., Piedras Negras and Federal District; Compañía Hierro y Acero de México, S. A., Federal District; and Hojalata y Lámina, S. A., Monterrey.

The industry developed in Monterrey and Monclova because of the favorable location of raw materials in the states of Coahuila and Durango; finishing facilities were built in the Federal District, a steel-consuming center; and natural gas from Texas was a factor in selecting Piedras Negras. In 1954, Mexico produced a total of 302,200 tons of iron ore, 217,000 tons of pig iron, and 591,935 tons of steel.

Ore Deposits.—Iron ore deposits occur in Durango, Michoacán, Oaxaca, Colima, Guerrero, and Lower California. Explored deposits are estimated to contain 290 million tons of ore. Fluorspar, manganese ore, limestone, and coal occur in Durango, Coahuila, Chihuahua, and Nuevo León, while mineral deposits suitable for making refractories are located near Monterrey. Coke plants have been built at Nueva Rosita, Palau, and Cloete in Coahuila. To stimulate the production of manganese ore five purchase contracts for a total of 133,500 tons were signed in 1953 by Mexican producers and the United States Defense Materials Procurement Agency. This and other contracts were intended to assure the United States of 550,000 tons of manganese ore for delivery during 1954–1957.

ARGENTINA

The iron and steel industry of Argentina was developed mainly after World War II. Production of finished steel amounted to about 4,500 tons in 1940; that of crude steel, to 339,000 tons in 1954. Plans reported in 1955 anticipated an annual capacity of 1,100,000 tons. Except for local scrap, the principal raw materials are imported.

At San Nicolás on the Paraná River, 37 miles southeast of Rosario, the Sociedad Mixta Siderúrgica Argentina has a blast furnace with a daily capacity of 1,200 tons of pig iron; four 160-ton open-hearth steelmaking furnaces; and rolling mills to produce rails, plates, sheets, structural sections, bars, and tin plate. The only other major steel producer is Acindar Industria Argentina de Aceros, S. A. Its production facilities at Villa Constitución, Santa Fé Province, include a blast furnace rated at 1,400 tons of pig iron daily; four 150-ton open-hearth furnaces; rolling mills to produce concrete-reinforcing bars, structural sections, wire rods, and strip; and a wire mill to produce galvanized wire and nails. At Rosario it has two 35-ton open-hearth fur-

naces with an annual capacity of 60,000 tons and rolling mills to roll concrete-reinforcing bars.

Among other Argentine steel producers are Establecimientos Metalúrgicos Santa Rosa, S. A., located at Tablada, Buenos Aires Province; La Cantábrica Sociedad Anónima Metalúrgica Industrial y Comercial, at Haedo, Buenos Aires Province; Dirección General de Fabricaciones Militares (Board of Military Manufactures), at Zapla, Jujuy Province; and Talleres Metalúrgicos San Martín, S. A., and A. B. K. Electrometalúrgica, both at Buenos Aires.

BRAZIL

In 1935, 52,011 net tons of iron ore, 70,638 net tons of pig iron, and 70,818 net tons of raw steel were produced in Brazil. Thereafter, through the large-scale development of domestic iron ore and coal deposits, plant expansion, and organization of new iron and steel producers, the country's iron and steel industry grew significantly both in output and in diversity of products. In 1954 its output was 1,910,000 tons of iron ore, 1,128,488 tons of pig iron, and 1,256,622 tons of raw steel.

Iron Ore and Coal Deposits.—Brazil's iron ore deposits are believed to be among the largest in the world. It is estimated that the iron ore reserves in the State of Minas Gerais amount to 15 billion tons, of which at least 1 billion are of high grade. Hematite ore is mined at Itabira, 50 miles northeast of Belo Horizonte in Minas Gerais, by the Companhia Vale do Rio Doce, S. A. The company is owned by the Brazilian government, which purchased the Itabira mines from the Itabira Ore Company in 1942. Coal deposits in the states of Santa Catarina, Rio Grande do Sul, Paraná, and São Paulo are estimated to contain 500 million tons, graded from low- to medium-volatile bituminous. Washing the coal yields (1) coal low in ash and sulphur, which can be blended with imported coal to make metallurgical coke, and (2) coal high in ash and sulphur, which is burned to generate steam.

Development of the Iron and Steel Industry.—Financial assistance by the United States government and technical assistance by United States engineers have been important factors in the expansion of the Brazilian iron and steel industry. In 1947 a \$14-million-loan was extended by the Export-Import Bank of Washington to the Brazilian government in order to expand mining facilities, improve the railroad from Itabira to the port of Vitória, and enlarge the ore-loading dock at Vitória. Other loans made by the bank to expand iron and steel production include: \$45 million extended during 1941–1943 to the Companhia Siderúrgica Nacional to build the first large Brazilian steel plant at Volta Redonda; \$25 million to the same company in 1950 to expand its annual raw steel capacity from 343,000 to more than 500,000 net tons; and \$67 million in 1953 to Industria e Comercio de Mineiros of Rio de Janeiro to supply at least 3,850,000 tons of manganese ore containing 45 to 47 per cent manganese to the United States for stockpiling purposes during the period 1956–1962. The last-named loan was intended to develop a 10-million-ton deposit of manganese ore in the Territory of Amapá.

The Companhia Siderúrgica Nacional began operating its Volta Redonda plant, 60 miles west-northwest of Rio de Janeiro, in 1946. It produces coke, pig iron, structural sections, plates,

bars, hot rolled sheets, cold rolled sheets, galvanized sheets, tin plate, and foundry products. The only other large iron and steel producer is the Companhia Siderúrgica Belo-Mineira, which has an annual capacity of 170,000 tons of steel. Plans to expand its capacity to 250,000 tons were reported in 1954. Its plants at Monlevade and Sabará in Minas Gerais produce pig iron, structural sections, plates, rails, bars, wire, and tubular products. The remaining iron and steel plants are located at Santa Barbara, Caeté, Coronel Fabriciano, Esperança, and Gagé in Minas Gerais and in and near the cities of São Paulo and Rio de Janeiro.

CHILE

The large-scale production of iron and steel in Chile began in 1950 with the opening near Concepción of the Huachipato plant of the Compañía de Acero del Pacífico, S. A. The plant's original annual capacity of 236,000 net tons of raw steel was about 10 times the national annual capacity of 1949. The initial plant investment was about \$87 million, of which \$48 million was supplied by the Export-Import Bank of Washington and the Koppers Company of Pittsburgh, Pa. The Huachipato plant was designed to supply domestic requirements and to provide a small surplus for export to Argentina, Uruguay, Bolivia, Peru, and Ecuador. The use of ocean carriers to deliver iron ore, coal, and other raw materials and to take away finished products was an important factor in locating the plant on San Vicente Bay. To withstand earthquakes the plant was cradled in concrete resting on sand, and in April 1949, before it was completed, it survived an earthquake. From July 1950 through June 1951 the plant produced 203,000 tons of pig iron. Its 1952 output of 241,000 tons of raw steel yielded 180,000 tons of finished steel: bars, galvanized sheets, tin plate, and welded pipe. In that year its annual capacity to make raw steel was increased to 260,000 tons; the estimated capacity for 1954 was 440,000 tons.

The Compañía Electro Metalúrgica, S. A., is the only other Chilean steel producer. In 1952 its Santiago plant had an estimated annual raw steel capacity of 3,100 tons and produced forged steel balls for grinding mills, spare parts for mining, agricultural, and manufacturing equipment, and alloy steel castings.

During 1952 the blast furnace at Corral, 190 miles south of Concepción, owned by the Compañía Electro Siderúrgica e Industrial de Valdivia, was operated by the Compañía de Acero del Pacífico. Its annual charcoal pig iron capacity was 29,000 tons in that year. The national pig iron production for 1954 was 333,906 tons.

The principal Chilean iron ore deposits are at El Tofo and El Romeral in Coquimbo Province. National output of iron ore for 1954 was 2,445,338 tons. In 1949 the Bethlehem Chile Iron Mines Company, a subsidiary of the Bethlehem Steel Corporation, contracted with the Compañía de Acero del Pacífico to mine 1,000,000 tons of iron ore a year and to deliver 350,000 tons a year to the Huachipato works; the balance was to be exported. At the same time, the two companies agreed to develop the El Romeral deposit by building a railway and port facilities, Bethlehem contributing \$6,500,000 and Acero del Pacífico \$2,500,000 for the development.

COLOMBIA

In 1953, Colombia had only one steel plant,

which produced steel bars at the rate of about 4,000 tons a year in a rerolling mill at Medellín, Department of Antioquia. In October 1954, a new, large-scale steel plant was opened about 130 miles northeast of Bogotá at Paz de Río, on the Chicamocha River, Department of Boyacá, for the Empresa Siderúrgica Nacional de Paz de Río, S. A. The cost of the plant was estimated at \$120 million, of which \$45 million was supplied by French bankers. Initial annual capacity was 150,000 tons of raw steel.

Iron ore was discovered near Paz de Río in 1942, and by 1952 proven iron ore reserves were estimated at 100 million tons. Both coal and limestone deposits occur within 25 miles of the town, probable coal reserves being estimated to exceed 130 million tons. The coal ranges from high- and medium-volatile to low-volatile bituminous. Extensive coal deposits also occur along the Cauca Valley in western Colombia, near the headwaters of the Patía River, in the Cundinamarca-Boyacá-Santander highlands, in the Department of Santander near the Venezuelan border, and in the northeastern part of the Department of Magdalena. Total national coal reserves, estimated at 12 billion tons, are among the largest in South America.

PERU

In 1955, Peru's first steel plant was being completed by the government-owned Corporación Peruana del Santa at Chimbote, a seaport about 250 miles northwest of Lima. Its equipment was to include two 100-ton Tysland-Hole electric reduction furnaces with a combined annual capacity of 60,000 tons of iron, two 30-ton electric furnaces with a combined annual capacity of 60,000 tons of steel, and three rolling mills. Its principal products were to be concrete-reinforcing bars, sheets for lightweight containers and drums for transporting petroleum.

The iron ore deposits of Marcona, 340 miles southeast of Lima and about 12 miles from the seaport of San Juan, are estimated to contain 170 million tons of probable reserves, and it is estimated that 100 million tons of this ore have an average iron content of 60 per cent. The Corporación Peruana del Santa has begun the development of these deposits by open-cut mining. The first shipments were made in 1953; shipments in 1954 were scheduled at the rate of 200,000 tons a month.

An exploratory drilling program was begun in 1953 by the Republic Steel Corporation on a deposit 37 miles southeast of San Juan and 20 miles from the Pacific Ocean. At Huancavelica, 140 miles east-southeast of Lima, there are iron ore reserves estimated at 70 million tons. Limestone and anthracite coal deposits in the Santa Valley near San Juan are being developed by the Corporación Peruana del Santa. Total national coal reserves are estimated to exceed 4 billion tons.

VENEZUELA

The only steel producer in Venezuela in 1955 was the Siderúrgica Venezolana Sivenso, S. A., which was organized in 1948 and began operating in 1951. Its plant at Caracas contains two electric furnaces which melt local scrap iron and steel and two rolling mills which produce concrete-reinforcing bars. The 1951 raw steel output was about 8,000 net tons, and outputs for 1954 and 1955 were estimated at 15,000 and 20,000

tons, respectively. No blast furnaces had been erected by mid-1955.

Venezuela's iron ore reserves, estimated at 2 billion tons, are in the State of Bolívar. The two major deposits are Cerro Bolívar and El Pao; others are Maria Luisa in the District of Heres; El Trueno, southwest of Cerro Bolívar; and San Isidro, near Cerro Bolívar.

The Cerro Bolívar deposit lies approximately 88 miles southwest of Puerto Ordaz, a port at the junction of the Caroni and Orinoco rivers. About 4 miles long, up to 4,000 feet wide, and averaging 230 feet thick, the deposit comprises the top and sides of a mountain formerly known as La Parida. Its name was changed in 1948 to Cerro Bolívar in honor of Venezuela's liberator. The deposit is estimated to contain at least 400 million tons of high-grade ore, mainly hematite and limonite with a small percentage of magnetite. The average grade reported in 1953 analyzed 58 per cent iron in the natural state, and in the dry state 63.5 iron, up to 0.10 per cent phosphorus, a low percentage of silica, and practically no sulphur.

The development of the Cerro Bolívar deposit necessitated the building of the town of Ciudad Piar at the base of the mountain, a highway extending 80.7 miles from the town to Puerto Ordaz, 91.3 miles of railroad from the deposit to Puerto Ordaz, and an ore-crushing plant, dock, and inland harbor 30 feet deep at Puerto Ordaz; and the dredging of 32 miles of channel 26 feet deep in the 178-mile Orinoco-Caño Macareo waterway from the inland harbor to the Gulf of Paria. A subsidiary of the United States Steel Corporation, the Orinoco Mining Company, began mining the Cerro Bolívar deposit in 1953. The first shipment of ore, comprising 6,700 tons, arrived in Philadelphia on Jan. 19, 1954, en route to the corporation's Fairless Works at Morrisville, Pa.

The El Pao deposit, 36 miles south of San Félix, has measured reserves estimated to contain 72 million tons of iron ore averaging 65 per cent iron. The Iron Mines Company of Venezuela, a subsidiary of the Bethlehem Steel Corporation, began to develop the ore body for open-pit mining before World War II. A 36-mile railroad from El Pao to Palua on the Orinoco River, ore-loading facilities at Palua, a transfer station at Puerto de Hierro on the Gulf of Paria, and three towns for workers were constructed. The first shipment of El Pao ore arrived at Sparrows Point, Md., on March 22, 1951.

Because Venezuela has large petroleum reserves, the search for coal has not been so intensive as that for iron ore. Coal deposits at Naricual in the State of Anzoátegui and at Coro in the State of Falcón are estimated to contain a minimum total of 200 million tons of high-volatile bituminous coal.

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IRON AGE. See ARCHAEOLOGY.

IRON CHANCELLOR, an epithet applied to Prince Otto von Bismarck (q.v.).

IRON CROSS. See DECORATIONS AND ORDERS—Germany.

IRON CROWN. See CROWNS AND CORONETS.

IRON CURTAIN, a term applied to the barriers to the exchange of persons and ideas erected by the Soviet Union between its satellites and western Europe. It was popularized following its use in a speech made by Winston Churchill at Fulton, Mo., in 1946.

IRON DUKE, an epithet applied to Arthur Wellesley, 1st duke of Wellington (q.v.).

IRON GATE or **IRON GATES**, a gorge in the Danube River between Orșova and Turnu-Severin, Rumania, on the Yugoslav border, at the western end of the Transylvanian Alps. About two miles long and very narrow, it was so encumbered with rapids that it hindered navigation until a canal was constructed in the 1890's. See also DANUBE.

IRON LUNG. See POLIOMYELITIS.

IRON MOUNTAIN, city, Michigan, seat of Dickinson County, situated at an altitude of 1,160 feet, 48 miles west of Escanaba. It is served by the Chicago, Milwaukee, St. Paul and Pacific and the Chicago and North Western railroads and by North Central Airlines. The trading center for an iron mining and farming area, it has establishments producing chemicals, clothing, and automobile parts. A large ski slide attracts many winter visitors. Settled in 1879 and incorporated in 1889, the city is governed by a mayor and council. Pop. 9,299.

IRON MOUNTAIN, peak, Missouri, the southern spur of the St. Francois Mountains, a low range in the eastern part of the state; altitude 1,077 feet. This mountain, which is really a hill or knob, is in St. Francois County, 38 miles west-southwest of St. Genevieve, the nearest point on the Mississippi River, on the Missouri Pacific Railroad. Its area is 500 acres.

Iron Mountain is famous for its remarkable deposit of hematite iron ore, the purest in the United States. Excavations were begun in 1845. An artesian well was sunk to the depth of 152 feet, with the result that the beds passed through from the surface were as follows: Iron ore mixed with clay, 16 feet; sandstone, 34 feet; magnesian limestone, $7\frac{1}{2}$ inches; gray sandstone, $7\frac{1}{2}$ inches; hard blue rock, 37 feet; pure iron ore, 5 feet; porphyritic rock, 7 feet; iron ore, 50 feet to the bottom. It would seem that nearly the whole mountain was a mass of magnetic iron ore. The adjacent valleys are underlaid with magnesian limestone in horizontal strata. Pilot Knob, about six miles south of Iron Mountain, also contained an extensive deposit of iron ore; Shepherd Mountain, a short distance southwest of Pilot Knob, is the largest of the iron mountains in the immediate vicinity. The Cerro del Mercado near Durango, Mexico, is another famous hill of iron.

IRON RIVER, city, Michigan; in Iron County, on the Upper Peninsula, 34 miles west-northwest of the city of Iron Mountain and 5 miles from the Wisconsin border; altitude 1,490 feet. It is a trading center for an iron-mining, lumbering, and agricultural region, and is served by the Chicago and North Western and the Chicago, Milwaukee, St. Paul and Pacific railroads. Settled about 1881, it was incorporated as a village in 1885 and as a city in 1926. Pop. 3,754.

IRONBARK, a name of several eucalyptus trees, the bark of which (except for *E. leucosylon*) is persistent, rather than deciduous as with other eucalypti. In general the hardness of their wood makes the ironbarks highly prized for ship-building and underground construction. *Eucalyptus paniculata* (white or red ironbark), the hardest of the ironbarks, has grayish brown bark, and wood which is generally pale in hue; *E. melanophloia* (silver-leaved ironbark), is a small tree, with dark, furrowed bark; *E. siderophloia* (broad-leaved ironbark) is tall, and much planted in the San Joaquin Valley, California; *E. crebra* (narrow-leaved ironbark) has reddish wood, is frost-resistant, and is found in many parts of California. Other ironbarks are *E. leucosylon* (white ironbark), bark deciduous; and *E. siderosylon* (red ironbark). Originally Australasian, like other eucalypti the ironbarks have been spread to most of the warmer parts of the world.

IRONCLAD OATH, The, an act passed by the United States Congress, July 2, 1862, requiring every federal office holder, civil or military, to swear allegiance to the Constitution and declare that he had never voluntarily borne arms against the United States. It was used to debar Southerners from office.

IRONDEQUOIT, à-rôn-dî-kwoit', town, New York; in Monroe County; bounded on the south by the city of Rochester. Chiefly a resi-

dential community and summer resort, it is situated on Irondequoit Bay and Lake Ontario.

In 1718 Jacques René de Denonville built the Fort des Sables on a sandbar in Irondequoit Bay, following visits by French explorers, notably Robert de La Salle in 1669 and 1678. First settled in 1791, Irondequoit was incorporated March 27, 1839. Government is by supervisor and council. Pop. 55,337.

IRONTON, i'ern-tûn, city, Ohio; seat of Lawrence County; altitude 540 feet. It is situated on the Ohio River, 93 miles south-southeast of Columbus, and is served by the Detroit, Toledo and Ironton and the Norfolk and Western railroads. Industrial production includes malleable castings, coke, graphite products, portland cement, chemicals, construction steel, electrical equipment, automobile parts, dry pressed brick, quarry tile, and stoves. The city has considerable river commerce; a bridge over the Ohio enables shippers to connect with the Chesapeake and Ohio on the Kentucky side. It has an airport, with airline service. There are three hospitals, one of which is a county institution.

The wealth of iron ore in this part of Ohio began to be exploited in the 1820's. John Means, of Virginia, made pig iron, with a charcoal furnace, here in 1826. In 1834 John Campbell experimented with new methods, and was so successful that the industry became firmly established here. He founded Ironton; it was incorporated in 1849. But the iron and steel industry shifted to other regions, and the furnaces have been supplanted by factories. The city government is administered by a city manager and council of seven. Pop. 15,745.

IRONWEED, in the United States the popular name for a genus, *Vernonia*, of tall, coarse, composite plants, several species of which grow abundantly in woods and along roadsides throughout the eastern and southern parts of the country as far west as Kansas and Texas. They bear heads of magenta-colored flowers somewhat like miniature thistles.

IRONWOOD, city, Michigan; in Gogebic County; altitude 1,505 feet. It is situated on the Upper Peninsula, on the Montreal River, opposite Hurley, Wis., and is served by the Chicago and North Western and the Soo Line railroads. It is the trading and shipping center of the Gogebic Range, rich in iron ore and timber. There is also dairying and truck farming in the area. The city has planing mills and manufactures of dairy and meat products. It is the seat of Gogebic Junior College (coeducational), a municipal institution founded in 1932.

Iron ore was discovered here by J. L. Norrie in 1884. The town was laid out and the railroad built to the site in the following year. Two years later it was incorporated as a village and received a city charter in 1889 and has city-manager government. Pop. 10,265.

IRONWOOD, a popular name for many trees whose timber is very hard and heavy. Probably the best known species in America is also known as leverwood, *Ostrya virginiana*, of the family Betulaceae, indigenous from Nova Scotia to Florida and westward to Minnesota and Texas. It is a medium sized tree with furrowed bark, birch-like foliage, pistillate flowers in catkins resembling the female flowers of hop,

hence its popular name, hop hornbeam. *Carpinus caroliniana*, the hornbeam (q.v.), is also sometimes called ironwood. Common Asian ironwoods are *Mesua ferrea*, often planted around Buddhist temples for its fragrant flowers, and *Metrosideros vera*, the iron tree of Java. Australian species include members of the genera *Olea*, *Melaleuca*, *Notelaea*, and *Myrtus*.

IROQUOIAN FAMILY, ȳr-ô-kwoi'ân, a linguistic stock of North American Indians whose ancestral home was in what is now the southern United States. Their name, which was given originally by the French to the League Iroquois, was subsequently extended to include the entire stock. The following groups are classified as Iroquoian: Huron (Wyandot); Tionontati (Tobacco); Neutral; Erie; Wenrohronon; Susquehanna (Andaste or Conestoga); Nottoway; Meherrin; Cherokee; and the Iroquois League (Mohawk, Oneida, Onondaga, Seneca, Cayuga, and Tuscarora).

When first encountered by white men, the Iroquoians lived as isolated groups among Algonquian, Siouan, Muskogean, and Uchean peoples. The problem of their dispersion and historic locations remains unsolved. The first contact with an Iroquoian people was made by Jacques Cartier, on the Gaspé Peninsula in 1534. (These Iroquoians were assimilated by their neighbors, for Samuel de Champlain found no trace of them 70 years later.) In 1540, Hernando de Soto discovered the Cherokee in eastern Tennessee and adjoining parts of Georgia and Carolina. Capt. John Smith was the first Englishman to contact an Iroquoian group, the Susquehanna, on Chesapeake Bay in 1608. In the following year, the Dutch discovered the League Iroquois between the Hudson and Genesee rivers, territory which they occupied until the close of the American Revolution.

The Iroquoians banded together in confederacies for mutual aid. Women were important: chiefs were nominated and retained title by female consent; women controlled land and all property except personal effects; and their communal gardens provided staples. Bark houses were large enough for several families, and early villages were fortified with stout palisades.

Except for the League Iroquois, only the Cherokee and the Huron-Wyandot survive. The others were defeated, dispersed, or assimilated by league members. The Cherokee now live in Oklahoma and North Carolina; the Huron, in Oklahoma and at Loretteville, Quebec, Canada.

See also SIX NATIONS OF THE IROQUOIS; separate articles on the various tribes.

GEORGE S. SNYDERMAN.

IROQUOIS LEAGUE, ȳr-ô-kwoi, the name given by the French and their Algonquin allies to the Five (later Six) Nations Indians of North America, the word *Iroquois* being a Gallicized form of *Irinakhoiw*, an Algonquin word meaning "real adders." These people called themselves Ho-de-no-sau-ne, meaning "long house building residents." The analogy of the long house was transferred to their political thought, and the member nations were considered brothers living in a house with five fires or rooms. The eastern door of the house was near Schenectady, N. Y.; the western door was the Genesee River; and the north and south walls were the St. Lawrence and Susquehanna rivers, respectively.

The Mohawk were the eastern doorkeepers; the Seneca, the western doorkeepers; the Onondaga, the keepers of the central fire. The Oneida and the Cayuga "sat along the north and south walls," respectively. The Tuscarora were admitted in 1722; they were "adopted" by the Oneida and therefore sat with them. Although they were allowed to sit in the Federal Council, they were never awarded league titles—that is, they were given membership without voting privileges.

The league was formed in the mid-16th century by Dekanawida and his assistant, Hiawatha. According to tradition, Dekanawida was born of a Huron mother in a village on the northeastern shores of Lake Ontario. After he had failed to persuade the Huron, Erie, Neutral, and other cognate tribes to adopt his plan for peace, he tried with the assistance of Hiawatha, a Mohawk, to convert the Onondaga. Failure forced the two men to take their message to other tribes. The Mohawk, Cayuga, and Oneida joined immediately, and the Onondaga and Seneca later on. The success of Dekanawida and Hiawatha was due to their political astuteness, personal characteristics, and the timeliness of their philosophy. Their plan was also acceptable because it allowed local autonomy. Theoretically, the league was one large family whose members lived in peace. Actually, it was a confederation of Indian villages whose chiefs constituted the Federal Council. The *Epic of Dekanawida* lists the founders in the order in which they accepted the plan. These names are now hereditary titles and are recited as part of the condolence ceremony when new chiefs are elevated.

Villages or tribes affiliating after the initial adoption of the Iroquois Constitution were allowed to speak but not to vote. Tribes were unequally represented in the council: the Mohawk and Oneida each had 9 chiefs; the Onondaga, 14; the Cayuga and Seneca, 8 each. The Cayuga and Oneida (younger brothers) and the Seneca and Mohawk (older brothers) caucused as separate units, while the Onondaga sat as impartial chairmen. Since each tribe voted as a bloc and unanimity was the rule, no tribe or group of tribes could dominate the league. A league chief held office for life or for as long as he performed his duties with devotion and honesty. Nominated by the matrons of the family holding the title, he was then elected by the village and raised to the Federal Council by the condolence ceremony. A crown of antlers symbolized both the office and peace. Chiefs wishing to go to war required permission from the council.

A chief was obligated to attend council meetings whenever he was summoned. He could be impeached for persistent absence from meetings, idle gossip, dishonesty, ambition to establish an independent authority, murder, and other offenses. The title was then given to another family, for the entire family was held responsible for the chief's behavior. Charges against a delinquent chief could be instituted by any adult. Failure to heed three warnings automatically resulted in his dismissal, and acceptance of the demotion by the league was perfunctory. Titles were loaned to other families when no suitable candidates existed.

War chiefs of the league led no armies, for the league had no constabulary: as a body it never declared war. Peace between league members was promoted by arbitrating local differences, but since the league freed its members from fear

of attacks by other members, it actually encouraged war on outsiders.

Shortly after the first quarter of the 17th century, league members quickly subdued the neighboring tribes of New York, New England, and Pennsylvania. They then turned their attention to the Algonquin, Huron, Tionontati, Neutral, Ottawa, Illinois, Erie, Susquehanna, Tutelo, and Catawba, but failed to conquer the Ojibwa in the West and the Cherokee in the South. Colonial governments found it profitable to deal with Onondaga, the capital of the league, for here were to be found ways and means of legalizing transactions—that is, war, peace, and land sales. These transactions were sometimes unacceptable to individual nations or villages, and the league found it increasingly difficult to control recalcitrants or to obtain general agreement on important issues. The political importance of the league finally ended when the federal chiefs bartered away the lands and sovereignty of their people for the brandy and bribes of the whites.

In the wars between the British and the French, which continued intermittently until 1763, the Iroquois fought for both sides. Some Mohawk Roman Catholic converts, for example, seceded from the league and were settled by the French in Quebec at St. Régis or at Caughnawaga. Other Mohawks, under the influence of Sir William Johnson, fought with the British. The league remained neutral in the American Revolution, but all the tribes participated, most of the Oneida and Tuscarora favoring the colonists. After the victory of the colonists, Joseph Brant led many of the defeated Iroquois to Canada, where they were given land by the crown. The Cattaraugus and Allegany Seneca seceded from the league after the Treaty of Buffalo Creek (1802). Only the Tonawanda Seneca and the Onondaga continue to adhere to the league politically.

Handsome Lake, the Seneca prophet, embodied the organization and many of the principles of the league in his religious teachings. The non-Christians who are his followers meet regularly to observe and discuss these principles. The Iroquois Constitution impressed and influenced the political philosophy of Benjamin Franklin, George Washington, and other founding fathers of the United States. Many of its principles were woven into the United States Constitution.

For social, economic, and other aspects of the Iroquois, see *SIX NATIONS OF THE IROQUOIS*; also separate articles on the individual tribes.

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IROQUOIS TRAIL, a main trail of the confederacy of the Five Nations of the Iroquois, established long before the white man trod New Netherland soil early in the 17th century. It began at the Hudson River on the site of Albany and ended at Lake Erie on the site of Buffalo. The Iroquois called it "Wa-a-gwen'-ne-yu," and the French Jesuit missionaries named it "The Beaten Road." From the site of Albany the path struck northwestward to the first of the Mohawk "castles" on the Mohawk River at Schenectady. Starting at the ford there, the trail continued upstream on both banks, the right-bank trail being most traveled because the Mohawk castles were on that side. This central Iroquois trail continued through Oneida country to the Onondaga Valley and the capital of the confederacy at Onondaga. After leaving Onondaga territory it

passed through Cayuga country to the valley of the Genesee River, heart of the Seneca lands, and so to Lake Erie.

Consult Morgan, Lewis H., *League of the . . . Iroquois*, vol. 2, chap. 3 (Rochester 1851; new ed., New Haven 1954).

IRRADIATION, ĭ-rā-dī-ă'shŭn, in optics, an apparent enlargement of a bright body when seen against a background darker than itself. This effect has been ascribed to the excitation of retinal cells just beyond those directly affected by the light, to defects in the human lens, and to light aberration by the atmosphere. Its chief practical effects have been in astronomy, where irradiation has made it difficult to measure planetary diameters with precision, has distorted the shape of the cusps of crescents, and, during eclipses, has enlarged Bailey's beads (the last points of light from the sun, shining through the unevennesses of the moon's surface).

ISAAC ASIMOV.

IRRADIATION, in physics, the exposure of any object to the influence of radiation, either electromagnetic or particular in nature. The term is used most commonly where radiation more energetic than that of visible light is involved. Irradiation can be cosmetic in purpose, as when ultraviolet light, originating in either the sun or in a mercury-vapor lamp, is used to induce a tan. It can also be therapeutic, as when ultraviolet light is used to treat skin disorders, or when X-rays or gamma rays are used to destroy malignant tissue.

Irradiation by ultraviolet light is capable of bringing about important chemical changes. Most notably, ring B of the molecules of certain steroids is ruptured with the production of compounds with vitamin D activity. In the layers beneath human epidermis, 7-dehydrocholesterol is present, and this is converted by solar ultraviolet light to cholecalciferol (vitamin D₃). This gives rise to the popular term, "sunshine vitamin" for vitamin D. Foods such as bread and milk contain steroids which can undergo similar changes, and it is common to enrich foods in this respect by irradiation.

Irradiation by X-rays or gamma rays can be deadly, and where destruction is desired, as in the case of malignant tissue, this is a useful fact. Gamma rays can be used to destroy insect eggs and to sterilize adult insects in raw foodstuffs such as grains and spices. This introduces a method of insect control which may eventually supersede chemical methods. Irradiation is more effective on eggs than are chemical insecticides, and it is more difficult for adult insects to develop resistance to gamma radiation than to chemicals. Furthermore, irradiation leaves no residue of potential harm to domestic animals or to humans.

Irradiation by gamma rays or by high-energy particles can also destroy bacteria in food within a sealed container. This opens the possibility of sterilization without heat or evacuation, so that food in plastic containers, rather than in the more expensive metal cans, may some day be stored at room temperature indefinitely.

Industrially, irradiation by gamma rays and high-energy particles has numerous uses. For instance, it can be used to bring about chemical changes in plastics, leading to sometimes desirable alterations in properties.



H. Cartier-Bresson from Magnum

In the delta of the Irrawaddy, the river teems with small-boat traffic.

Irradiation can be measured as the radiant power (in watts) per unit area. This is called "specific irradiation" or "irradiance." The "total irradiation" is the irradiance multiplied by the total area of the object being irradiated.

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IRRATIONAL NUMBERS, *ir-rāsh'un-āl*, numbers that are not integers or fractions (natural or rational numbers); numbers that are incommensurable with unity. Generally such numbers arise in the processes of mathematical operations, such as the extraction of roots and the solutions of equations. They cannot be represented exactly either as sums, differences, products, quotients, or integral powers of natural numbers (repeating decimal fractions arising in divisions, such as $2 \div 7$ or $3 \div 13$, are not included). Thus $\sqrt{2} = 1.4142 \dots$ is an irrational number. An irrational number contains a decimal part in which the sequence of the digits does not exhibit any known or hidden regularity.

The ratio, π , of the circumference of a circle to its diameter is a special type of irrational number, known as a *transcendental*. The approximate value, $\pi = 3.14159 \dots$, has been computed electronically to more than 2,000 decimal places. The values of logarithmic and trigonometric functions are also transcendental. The Russian mathematician Izrail M. Gelfand (1913-) has demonstrated that any rational number raised to an irrational power results in a transcendental number. Thus $3^{\sqrt{2}}$ is transcendental.

The German mathematician Richard Dedekind (1831-1916) suggested the representation of an irrational number in terms of a "cut" of two sequences of numbers: one contains values all less

than the value of the irrational, while the other contains all values greater than the value of the irrational. But the irrational number itself does not belong to either of these two sequences. Thus $1.4142 \dots < \sqrt{2} < 1.4143 \dots$

Consult Newman, James R. (pseud. Paul Stryfe),
The World of Mathematics, 4 vols. (New York 1956).

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IRRAWADDY RIVER, *ir-ā-wōd'ī* (sometimes IRAWADI), river, Burma, running from the extreme north of the country generally southward to the Andaman Sea. Its sources are two rivers, the Mali Hka (west) and Nmai Hka (east), which rise in Kachin State near the border of Tibet and run parallel southward to unite above Myitkyina ("near great waters"). From Myitkyina to Bhamo (91 miles) the river is navigable to steamships during the low-water season (October-February); in this stretch its width is about 900 yards. Just north of Bhamo the river bores its way through the hills in what is called the First Defile. The hillsides are steep, the width closes in to 100 yards, and the depth exceeds 30 fathoms. After the monsoon the river rises 50 feet or more in this defile, preventing navigation.

Just below Bhamo the river enters the Second Defile; it broadens out again, then after about 90 miles enters the Third Defile, which continues for 20 miles but is much wider and does not produce such a strong current as the higher defiles. From Bhamo to Mandalay is 275 miles, and from Mandalay to Rangoon, the capital, is 597 miles. Eighty miles below Mandalay the river is joined by the Chindwin River, which is almost as long and wide as the Irrawaddy. The

river is now a mile wide in places, creating great bends, with mud banks that are islands except during floods.

In its lower reaches in the delta the river becomes a maze of meandering tidal creeks, draining into the sea through 10 main channels. The Rangoon River is not actually an effluent of the Irrawaddy, but Rangoon is joined to the main stream 22 miles to the west by the Twante Canal, navigable by large river steamers. The total length of navigable water (Bhamo to the sea) is approximately 900 miles. The river is spanned by one bridge only, the Ava Bridge, just below Mandalay, which carries road and rail.

Economic Importance.—The Irrawaddy is the main artery of Burma. River steamships are operated by the state Inland Water Transport Board, but about half the traffic is carried in private boats, propelled by sail and oar. From the forests of the north, and from around the Chindwin, come great "rafts" of thousands of logs chained together. Oil from Chauk is carried down to the Syriam refinery, opposite Rangoon. From all over the delta comes the rice crop. Every few miles up the river are little market towns, some with a specialty—for example, Shwegu (pottery) or Pagan (lacquer ware). The total volume of trade carried is about equal to that of the railroad system running southward to Rangoon. Navigation, however, is much more hazardous than formerly. During the Japanese invasion of 1942, the steamer fleet was taken upriver and deliberately sunk, as a barrier, just south of Mandalay. In 1961 many ships still remained there, half submerged.

History.—Most of the history of Burma relates to the Irrawaddy. In the extreme north, the watershed between the eastern source of the river (Nmai Hka) and the Salween River in China was regarded by the government of Burma, both before and since independence, as the "natural" frontier between Burma and China. This claim was long disputed, but in January 1960 Communist China at last recognized it. During the 1880's and 1890's, China had laid claim to Bhamo as a "free port" on the Irrawaddy. Bhamo, 30 miles from the frontier, is the main outlet for trade between the Chinese Province of Yunnan and Burma. The claim was rejected, though Bhamo remained a community of Chinese. Eight former capitals lie on or near the river. The most northern is Tagaung, followed by Shwabo, and then (all near together) Mandalay, Amarapura, Ava, and Sagaing. From 1364 to 1885, though the actual site was often changed, the capital stood just above the great westward bend of the Irrawaddy near Mandalay. Over 100 miles downriver stands Pagan (capital, c. 1050-1287), and 160 miles lower still is Sri Ksetra or Old Prome (capital, 638-832).

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IRREDENTISTS, ır-ê-dên'tists, members of an Italian nationalist movement for the annexation to Italy of territories—*Italia irredenta* (unredeemed Italy)—inhabited mainly by Italian-speaking people, but remaining under foreign rule after 1866. The phrase *Italia irredenta* was first used by Matteo R. Imbriani in Austrian-held Trieste in 1877. "Irredentism" has often been used also to describe nationalist agitation in other countries for the incorporation of terri-

tories that remain subject to foreign rule.

Italian irredentism was an extension of forces set in motion during the Risorgimento, culminating in the wars of Italian unification (1859-1866). The unification of Italy had been achieved at the expense of Austrian territorial possessions and influence in the Italian peninsula. Since Austria continued after 1866 to rule several Italian-inhabited areas claimed by Irredentists, it was the main target of Irredentist agitation.

Associations for *Italia irredenta* were first formed in 1877 under the leadership of Imbriani, Giuseppe Avezzana, Giovanni Bovio, Luigi Zuppetta, Roberto Mirabelli, and others, with the support of Giuseppe Garibaldi, Federico Campanella, Giosuè Carducci, and other ex-Garibaldians. The various Irredentist groups within Italy and beyond its frontiers were by no means in accord regarding their objectives. For some organizations the goal was limited to those Italian-speaking territories north and east of Italy under Austrian control (Gorizia, Trentino, Istria, and Trieste). Other, less numerous Irredentist groups pressed for the redemption of Corsica and Nice, which formed part of France, and of British-held Malta. Moreover, even those who focused their efforts on Austrian-held territories disagreed on whether to extend (for strategic reasons) the northern frontier to the Brenner Pass, which meant absorption of many German-speaking people. The question of methods to obtain these objectives further divided the movement between those in favor of peaceful solutions and those urging war if necessary. The division of effort and lack of a common program were even more evident among Irredentists living under Austrian rule. Many of them made it clear that they were concerned only with the Austrian-controlled area in which they lived and not with other Irredentist territories. Generally, the immediate objectives of Italians under Austrian rule were more educational privileges and greater political autonomy.

Despite internal divisions, the Irredentist movement was a significant force in Italian politics, particularly as it affected foreign policy, from 1877 to World War I. During the last two decades of the 19th century, Irredentist activity was frequently repudiated by the Italian government, which feared that it would endanger Italy's efforts to strengthen ties with Austria and Germany through the Triple Alliance. The gradual shift in Italian foreign policy which produced a rapprochement with France after 1900 diminished the pressure of official disapproval.

Italy's entry into World War I on the side of the Allies was in part the result of organized pressure by Irredentists, among whom Gabriele D'Annunzio was a prominent figure. Italy's territorial gains at the Paris Peace Conference of 1919 fulfilled the hopes of most Irredentists and brought the movement to a climax. Nevertheless, residual problems remained, and it was not until 1954 that Italy and Yugoslavia reached a settlement on Trieste.

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IRRIGATION, ĩ-ĭ-gā'shūn, the watering of land artificially in order to produce crops. In the simplest cases water is drawn from a well or a stream and is poured into a small ditch from which it runs over the land. This is practiced by single farmers or by small groups in arid countries all over the world. Larger communities need more complicated systems, in which rivers supply canals and these subdivide into branches which carry the water to all parts of the cultivated areas. The largest systems involve the development of entire river basins by means of great engineering works, canals, regulators, and dams.

The largest irrigated areas are to be found in India, China, western United States, the USSR, Egypt, Iraq, South Africa, southern Europe, Australia, and South America. The area is continually expanding.

Ancient Irrigation.—Irrigation began as a natural phenomenon in places like Egypt and Mesopotamia, where there is almost no rain but the rivers rise in flood every year and in prehistoric times inundated large areas along their banks. When the floods subsided, seeds were planted in the mud, and crops matured on the water left in the soil. The first artificial irrigation probably began by taking water from the pools which remained in depressions for months after the flood water had retreated, and this led to the invention of primitive lifting machines like the Egyptian shadoof (denkli or paecotta in India). It also led, where conditions were favorable, to the damming of the exits of depressions with stones and earth in order to hold up a bigger supply of water for later use. It is a tradition that Menes, the first king of unified Egypt (fl. about 3100 B.C.), built banks to control the Nile and so originated the basin system of irrigation which continues to this day in the southern part of Egypt. At any rate, there is no doubt that irrigation was practiced in Egypt long before historical times, which date between 4000 and 3000 B.C. Traces of ancient canals still remain also in Iraq, and there are traditions of works

carried out by Nimrod (fl. perhaps about 2450 B.C.).

The flood of the Nile was always a dominant factor in the life of Egypt. Even in ancient Egyptian times there were Nilometers or scales for measuring the height of the river, and the ruins of some of these still exist. A later one on Roda Island, Cairo, dates from about 711 A.D. and was in use up to the 20th century, when extensive repairs were necessary. The well and the pillar on which the scale stands were later shut off from the Nile and surrounded by a concrete curtain, so that the Nilometer would remain indefinitely as the oldest Arab monument in Egypt.

Records of flood levels on this Nilometer and on one of the earlier devices go back with breaks to 622 A.D.

Primitive machines, dating from ancient times, are still in use in the East for lifting water. One is the *shadoof*, consisting of a long arm pivoted between two posts. The shorter part of the arm carries a weight of stone or a ball of clay, and the longer part a rope or long stick to which a bucket is fastened. This is set up beside a pool, water-course, or well. The worker pulls the longer arm down until the bucket dips into the water, and then, assisted by the counterweight, lifts the full bucket and pours the water into the ditch, which carries it onto the land. Sometimes shadoofs are used in series one above another.

Another contrivance, for use where the lift is small, is the *Archimedean screw*, which consists of a wooden cylinder with a helix inside and an axis at both ends (or alternatively a helix twisted around a cylinder). It is mounted on posts with one end dipping into the water, and a crank on the upper end of the axis is turned by one or two men sitting in the water, so that water rises in the helix and flows out at its top. The *sakieh* or *Persian wheel* consists of a vertical wheel on a horizontal axis with a series of pots round its rim. Attached to this axis by a shaft is a toothed wheel into which a horizontal toothed wheel gears. A cow, buffalo, or camel, attached to this horizontal wheel by a shaft, turns it by walking in a circle. As the wheel turns, the pots dip into the water, fill, and when they reach the top of their circle, empty the water into a trough and so into a field ditch. If the water is low, the pots are fastened to an endless rope which passes over the wheel. A modern development of the *sakieh* can be seen in Thailand, where a windmill is used to turn the wheel which carries the string of pots. The shadoof is much earlier than the Archimedean screw or the *sakieh*, and there are pictures of it on ancient Egyptian monuments, where scenes relating to irrigation occur in very early times.

MODERN IRRIGATION PRACTICE

Flood and Perennial Irrigation.—Irrigation on a large scale is practiced only on fairly flat ground, such as the flood plains of rivers. In this there are two general systems: irrigation only when the river is in flood; and perennial irrigation. In Egypt, in flood or basin irrigation, as it is called there, the narrow strip along the Nile, bounded by desert hills on either side, is divided into basins of 1,000 to 40,000 acres by cross banks from the river to the desert. Water is admitted into these basins by canals through the longitudinal bank along the river when the river rises in flood. The water remains

In Egypt, a cow turns a *sakieh* or *Persian wheel*, a primitive irrigating device used since ancient times.

Elliott Erwitt from Magnum





FAO

Above: Flood irrigation is practiced in rice paddies in Ceylon. Earth ridges divide the paddies into compartments.

Right: A farmer feeds a chemical fertilizer directly into water flowing to his furrow-irrigation project.

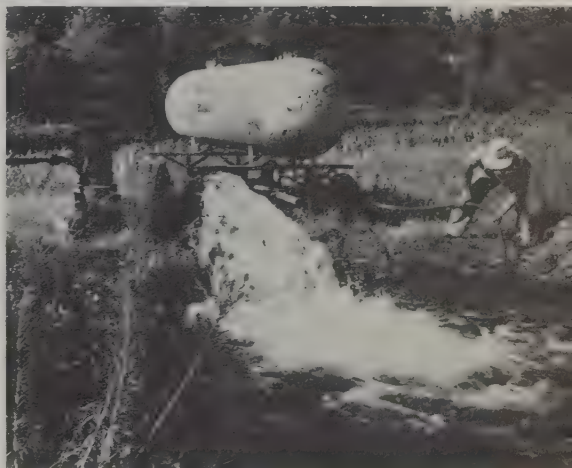
Citiles Service Company

on the land for several weeks and is then run off by escapes into the river, which by this time has fallen.

In modern Egypt only about one sixth of the cultivated area remains on the basin system; the remainder has been converted to perennial irrigation. In perennial irrigation, water is given at suitable intervals throughout the year. In large-scale irrigation it is brought from a river by main canals to branch canals and then to smaller canals which feed the permanent channels by which water is brought to the individual fields. As the river supply is usually variable, reservoirs are necessary to make the most of it by storing water from times of high supply to times of low supply.

Distribution Methods.—When the water reaches the field, there are two principal types of distribution: *flood irrigation*, in which the area is divided into compartments with fairly flat surfaces and water is run on to cover the whole of the surface; and *furrow irrigation*, in which the land is laid out in ridge and furrow and the water is run into the furrows and does not cover the whole surface. Grain and forage crops are usually flooded, while cotton, maize, potatoes, sugar beet, and most crops grown in rows are watered by furrows. The same piece of land is often used for either type of distribution, and on the same farm some will be under flood and some under furrow irrigation.

In one layout for flood irrigation, a field is divided into small basins or checks by ridges (or levees) and field ditches, and each basin is flooded from a field ditch. Where the field is not very level, the ridges may approximately follow the contours, and the field ditches follow the gradients. In another layout the field may be divided by broad ridges into long, narrow strips sloping away from the field ditches, so that the slope across the strip is small. The



water flows in from the ditch at the top end of the strip and slowly makes its way to the bottom end, wetting the whole strip as it travels. This is known as border strip flooding.

In furrow irrigation, the furrows usually run down the steepest slope away from the field ditch. They vary in length, up to a quarter of a mile. The spacing of the furrows is arranged so that the plants are on the ridges with the furrows between them, with distance between the rows suitable to the plants. Two rows of plants may be on one ridge. In watering, a small opening is made through the bank of the ditch, and the water is allowed to flow into one or more furrows. Below the opening, the ditch is dammed, sometimes with earth taken from the cut in the bank and sometimes with a portable dam of wood, steel, or canvas.

In more recent times irrigation by *sprinklers* has come into use, and portable systems have been devised with aluminum pipes and couplers. The pressure needed can in some circumstances be produced by gravity, but usually a pump is needed. Sprinkler systems are satisfactory where the land has an irregular surface or would be



Aluminum Company of America

A sprinkler system of aluminum piping is used to irrigate a large cultivated area.

difficult to irrigate by surface methods. They are also suitable where the soil is very permeable and has a small capacity for holding water, so that it needs light waterings at short intervals, or where the water table is high.

Crop Requirements.—An important quantity in irrigation practice is the amount of water required to grow crops. This varies with the crop, the nature of the soil, the temperature, humidity, and rainfall. In some places—for example, Egypt and parts of the United States—the rainfall is negligibly small so that all the crop requirements must be supplied by irrigation. At the other extreme are places with a fair but capricious rainfall, where a little irrigation at the right times can improve crop yields considerably. Such areas exist in many parts of the world—for example, in America, East Africa, and even in the southeast of England.

In addition to the requirements of the crop plants, allowance must be made for evaporation losses from the soil, transpiration from weeds, and in large irrigated areas for transmission losses from canals and reservoirs. When water is available, farmers usually tend to give more than the economical amount on which crops can be grown. Most crops show a certain amount of tolerance, however, and variations of 10 per cent from the optimum cause only small variations of yield.

Regulators span an irrigation canal near Yuma, Arizona.

Lanks from Monkmeyer



A great deal of research on water requirements in relation to climatic conditions, nature of soils, and subsoil water levels has been carried on all over the world. In Egypt, cotton during its growing season requires about 3 feet depth of water in Lower Egypt and more in Upper Egypt. Rice, which grows in water, requires about $2\frac{1}{2}$ times as much as cotton. In South Africa, grain crops can usually be grown with 15 inches depth of water. In the western United States the water requirements for cereals (excluding rice), sugar beets, cotton, and potatoes, vary for a single crop from 1 foot to $3\frac{1}{2}$ feet depth of water including rainfall. Alfalfa and forage crops require more water than the preceding, averaging about 3 feet. In very hot, dry regions these figures are exceeded. Rice requires from 4 to 10 feet.

Canal Systems.—The perennial irrigation of large areas requires a river as the source and a canal system as a means of distributing the water. The system usually consists of main canals taking directly off the river, branch canals or laterals, and distributaries from which water is turned into the permanent ditches which serve large farms or groups of small farmers. In order that the level in the canals may be high enough to allow a free flow of water onto all the land to be served, and also that each canal may receive its proper share, a system of regulating works is necessary. On the river below the offtake of a main canal, a barrage or diversion dam is built. It usually consists of a masonry work like a bridge, and contains enough sluices to pass the whole discharge of the river in flood; or part of the flood discharge may be carried by a spillway. Above this barrage are the head regulators of the main canals, which take off the river at this point which are similar to the barrages, with sluices. By manipulating the sluices in the barrage and in the canal head regulators, the river is kept at a suitable level, and each canal receives its proper share of water. Regulators on a main canal enable the branch canals to receive their shares, while single sluices control the supply to farm ditches.

Economical and fair distribution depends on careful measurement of the water in the river and in the canal system at all salient points. With good design and test measurements of the flow through the sluices, a regulator can be converted into a water meter. After these measurements, the discharge can be calculated from the

number of sluices open and the amount of opening, combined with the levels upstream and downstream of the regulator. The canals are designed according to the areas which are dependent on them, and the distributaries are worked on a timetable so that the main and branch canals run steadily and the water is evenly distributed over the area.

Storage Reservoirs.—The flow of most rivers is variable. As long as the demand for water is below the minimum discharge, this variability does not matter; if it increases beyond the minimum, storage from times of plenty is necessary to make up deficits that occur when the river is low.

A storage reservoir is made by building a dam across a river at some suitable site which provides a good rock foundation and a large capacity above the site. The sluices and spillways in the dam enable the river discharge issuing from the reservoir to be controlled so that excesses over requirements can be stored and later deficits made up from storage. Water not required for irrigation is allowed to flow over the spillways at the sides of the dam or through valves to the river below.

Where the rainfall has a seasonal distribution, the rivers have an annual regime, and this leads to a fairly regular annual procedure of filling reservoirs in floodtime and emptying them when the river is low. The need has become apparent in some cases for a further stage in storage, namely, overyear storage from good years to bad years, and this point has been reached on the Nile.

Drainage.—All water used for irrigation contains mineral matter in solution. Consequently evaporation from land cultivated by irrigation tends to concentrate these mineral salts in the surface soil. To avoid this, it is necessary to have drainage so that water can percolate through the soil and dissolve out concentrations of salts. The fields are drained by small ditches or tile drains, which run into collector drains that are usually parallel to and between the tributary canals. Canals are sited on the higher ground, and the drains in the lower. The continued use of saline water for irrigation causes deposits of salts and soil deterioration so that crops cannot be grown. Sodium chloride and bicarbonate are the most harmful; water whose content is more than 700 parts per million of dissolved matter, consisting mainly of these salts, will do harm if used regularly for irrigation. Without drainage, lower concentrations will be harmful.

MAJOR IRRIGATION SYSTEMS

United States.—The western half of the United States, except for a strip along the coast averaging about 150 miles wide, has an annual rainfall of less than 20 inches. In the areas best suited for farming, the rainfall is insufficient in the growing season to produce good crops. Irrigation, which was early practiced by the Indians of the Southwest, has now developed until about 25 million acres are irrigated; more than three quarters of this development has been accomplished by private enterprise. About 170 million acres are cultivated by dry farming, but the greater part of suitable land is still uncultivated. The Bureau of Reclamation estimates from stream measurements that the available water is enough for the irrigation of another 17 million

acres. The principal irrigated crops are rice, sugar beets, vegetables, and fruits, which are almost entirely grown by irrigation; of the cotton, hay, and forage crops less than half are irrigated. Food grain crops are mostly grown by dry farming.

In drawing up projects for irrigation, it is advisable to combine it with other objectives, if possible, though the demands of irrigation, hydroelectric power, navigation, and domestic and industrial water are not entirely compatible. In the United States two large undertakings of this kind may be mentioned: the Colorado River and Columbia River projects. The principal work in the Colorado Basin is the Hoover Dam in Boulder Canyon, which serves several purposes. It provides a storage reservoir with a capacity of 32 million acre-feet (40 billion cubic meters), second in size only to the reservoir created in Lake Victoria by the construction of the Owen Falls Dam (200 billion cubic meters gross). It regulates the lower course of the river for irrigation and flood protection, provides domestic and industrial water for southern California, and produces large quantities of electric power, which is used in California, Arizona, and Nevada. The largest irrigation area dependent on the Colorado is in the Imperial and Coachella valleys, to which water is brought by the All-American Canal, taking off the river above the Imperial Dam. The total area irrigated in the two valleys is more than 500,000 acres.

The area known as the Columbia Basin Project contains more than 1 million acres of irrigable land, to be irrigated from the Grand Coulee Dam and subsidiary dams and works. The Grand Coulee, completed in 1942, was the largest masonry structure built up to that time, and attached to it is one of the world's largest power plants. Part of its power is assigned to pump water from Lake Franklin D. Roosevelt, formed by the dam, up to an equalizing reservoir in the Grand Coulee, which serves the canals. The pumping plant, when completed (by 1960, 6 of the ultimate 12 hydraulic pumps had been installed), will be able to pump 19,200 cubic feet (544 cubic meters) a second to a height of 280 feet. Working at full bore it would use one third of the power of the station. The pumps, however, are operated during the off-peak period and so do not interfere with commercial demands. These projects and many others have been carried out by the Bureau of Reclamation in the Department of the Interior. Repayments to the government for construction costs come primarily from water users on the irrigation projects and from the sale of power generated by hydroelectric plants operated in connection with some of the dams.

Nile River Basin.—The Nile, with its length of 4,160 miles and its varied basin, presents most of the problems involved in the utilization of water on the largest scale. The greater part of its water comes from rain falling on the mountains of Ethiopia from April to October. The result of this is that the river in Egypt and the Sudan rises to a peak in August and September and falls to a minimum in May. The average extreme 10-day mean volumes are about 730 and 45 million cubic meters (tons) per day on the main river where it enters Egypt.

Egypt is entirely dependent on irrigation (more than 6 million acres cultivated), the Sudan partly so (more than 1 million acres irrigated), and in the southern part of the basin where rain

crops are grown, the advantage of supplementary irrigation is beginning to be realized. So far the supply is insufficient for present cultivation from the beginning of February to the end of July, on the average, and is supplemented by storage from the floods. This storage is held behind the Sennar Dam on the Blue Nile, for the use of the Sudan; and by the reservoirs formed by the Jebel Aulia Dam on the White Nile, just above Khartoum, and the Aswan reservoir, for the use of Egypt. The low-stage supply supplemented by the stored water is distributed according to forecasts based on the fairly regular fall of the river after the flood and, when the river begins to rise, on the amount of water arriving in the southern Sudan. A short supply is met by reducing the allowance to the standing crops, limiting the rice area to suit the supply, and delaying the irrigation of fallow land until reports arrive from the upper reaches that a sufficient supply is on the way.

The limit of cultivation possible with these reservoirs has been reached and in years of very low flood cannot be completely supplied. It is therefore necessary to look to overyear storage so that the good years can help the bad. Such storage is possible in Lakes Victoria and Albert in central Africa and has been provided in Lake Victoria by the Owen Falls Dam at the exit of the Nile, which also provides power for Uganda. However, the storage is of little use to Egypt and the Sudan until dams are constructed to regulate Lakes Kioga and Albert, and the Jonglei Canal is completed to bypass the swamps of the Sudd region in the southern Sudan, and so reduce to a reasonable proportion the loss of 50 per cent of the water which takes place there. The construction of these projects would make it possible

to obtain nearly the maximum benefit from the White Nile by overyear storage.

The largest volume of unused water remaining after this lies in the excess flood waters of the Blue Nile and Atbara River, which at present escape to sea. This is a very variable quantity, since in the lowest year on record the total supply of the Nile would be insufficient for the needs of present cultivation, while in a high flood it would be double the requirements. To deal with these variations, overyear storage is required, preferably on the main Nile. For this purpose the High Aswan Dam project has been proposed by Egypt, to be used for annual working, for overyear storage, for flood protection, and for hydroelectric power. Other projects for annual storage for use in the Sudan are dams on the Blue Nile at Roseires, not far from the Sudan-Ethiopian frontier, and on the Atbara.

Many difficulties have to be overcome, apart from those of construction, before such a complicated system of projects can be made into a smoothly working machine. Operation will be based on the regular measurements, made for many years, of the flow of the principal tributaries at salient points all over the basin. The technical advisers of the Sudan government, collaborating with International Business Machines, have made an investigation by means of an electronic computer of the possible effects of various combinations of projects, old and new, on the regulation of the Nile, using the records of 50 years. No doubt, as further projects are constructed, electronic computers will be used to make the forecasts and to deduce from them the suitable regulation of the multiple projects.

Another complication is that the Nile is an international river flowing through seven countries, in all of which the population is increasing rapidly, and all have an interest in some degree in the regulation of the river. Since water requirements for all the potentially irrigable land in the basin are more than the supply of the whole river, even if used to the last drop, maximum benefits can be obtained from the river only by the close collaboration of all the basin countries.

Dams, Canals, and Other Works.—The world's most spectacular constructions for irrigation and other purposes are the great dams built of hewn stone, concrete, or earth. Particulars of some large dams are as follows.

Dam	Height (feet)	Length (feet)	Type	Purpose ¹
Grand Coulee, U.S.	550	4,173	Concrete	I, F, P, R
Shasta, U.S.	602	3,460	Concrete	I, F, P
Hoover, U.S.	726	1,244	Concrete	I, F, P, R
Fort Peck, U.S.	250 ²	21,026	Earth fill	F, P, N
Aswan, Egypt	140	7,000	Granite	I, P, N

¹ I, irrigation; F, flood control; P, power production; R, river regulation; N, navigation.

² Height above stream bed.

The Bhakra Dam on the Sutlej River in India, scheduled for completion in 1962, will have a height of 680 feet. Two high dams, higher than anything existing, had been proposed, but were later dropped. Of these the proposed Kosi River Dam in the Himalayas was replaced in 1953 by a barrage, diversion channel, and embankments. A very high proposed dam in a gorge of the Hwang Ho (Yellow River) in China was replaced in 1957 by a large multipurpose scheme for flood

Reservoirs of irrigation water for Egypt are controlled by the Jebel Aulia Dam near Khartoum in the Sudan.

George Rodger from Magnum



control, irrigation, power, and navigation. The scheme consists of 5 dams forming large storage reservoirs, 1 dam being nearly 400 feet high and another with a reservoir capacity of 60 billion cubic meters (50 million acre feet), as well as a number of regulating dams or barrages. The largest barrage in the world is the Sukkur Barrage on the Indus River in Pakistan, which is nearly a mile long and diverts water into 7 large canals with a discharging capacity of more than 40,000 cfs. (cubic feet per second). A barrage at Kotri lower down the Indus, of about the same size as the Sukkur Barrage, was completed in the 1950's, increasing the irrigated area in the lower river and in its delta. (See also DAMS.)

Other important irrigation works are canals. One of the largest is the Ibrahimiya Canal, which irrigates Middle Egypt; it has a length of 250 miles and a maximum discharge of 29,000 cfs., which irrigates 1¼ million acres. The All-American Canal in California has a maximum discharge of 13,000 cfs. and irrigates about half a million acres. The Godavari and Kistna canal systems in India each have total discharges of 14,000 cfs. and dependent areas of about 1 million acres. The proposed Sudd Diversion (Jonglei) Canal in the Sudan was projected to carry 22,000 cfs. but may ultimately carry more. The Grand Canal of China is the oldest and longest canal in the world. Begun in the 7th century and completed in the 13th and 14th centuries, it extends from Hangchow, south of the Yangtze River, to north of the Hwang Ho, where it connects with the Pei Ho on which is Tientsin. It was part of an extensive system of artificial channels, connecting several river systems, which enabled irrigation to be developed in the flat Yangtze River area.

Another type of work that is sometimes an adjunct to irrigation projects is the aqueduct, which also has a long history. Perhaps the largest is the Colorado River-Los Angeles Aqueduct (240 miles long), which delivers water to Los Angeles and 12 other Californian cities. (See also AQUEDUCTS.) Tunnels also play a part in transferring water from the watershed of one river to that of another. Of these the Alva B. Adams Tunnel (13 miles long) through the Rocky Mountains in Colorado may be mentioned, and also the projected tunnels of the Snowy Mountains Hydroelectric Scheme in Australia. See also TUNNELS AND TUNNELING—*Tunnel Classes and Their Characteristics* (Water Tunnels).

Projected Expansions.—Irrigated areas are expanding all over the world. Besides the United States with 25 million acres, India with 80 million acres (35 million from canals and the remainder from wells) has many projects under way. Communist China in 1957 announced a program that would more than double its irrigated area, increasing it to 150 million acres. The USSR has begun large schemes of expansion in south Russia from its rivers, and also east of the Caspian Sea. Iraq is likewise expanding its irrigated area. Besides the Nile projects, there are undertakings for development in North and West Africa and in South Africa, as well as in South America and Australia.

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IRTYSH RIVER, ĭr-tish', river, USSR, in Central Asia and western Siberia. About 2,750 miles long, the Irtysh is the longest tributary of the Ob River, which it joins on the left side; it rises in the northern part of China's Sinkiang-Uigur Autonomous Region, where it is known as the Black Irtysh. Descending from the west slopes of the Mongolian Altai Mountains, the river flows west into Lake Zaisan in the Kazakh SSR. On leaving the lake, it assumes the name Irtysh and flows generally northwest past the Kazakh cities of Ust-Kamenogorsk, Semipalatinsk, and Pavlodar, and past Omsk and Tobolsk in Siberia to join the Ob River near Khanty-Mansk.

The Irtysh River receives several important tributaries, including the Bukhtarma, Om, and Tara rivers on the right, and the Ishim and Tobol rivers on the left. During the ice-free navigation season, which lasts from May to November, the river is used by shipping over virtually its entire course. The upper course of the Irtysh has a precipitous fall favorable for the construction of large hydroelectric stations. The 330,000-kilowatt Ust-Kamenogorsk station was opened in 1952, and the Bukhtarma station (435,000 kilowatts), situated 15 miles below the mouth of the Bukhtarma River, was opened in 1960. The Bukhtarma reservoir, when filled, will merge with Lake Zaisan and raise the lake level by 30 feet. The Irtysh power stations supply the mining and smelting industries of eastern Kazakhstan. The river is a potential source of water for the industrial area of central Kazakhstan, which is to be supplied by the planned Irtysh-Karaganda Canal.

THEODORE SHABAD,
Author of "Geography of the USSR."

IRÚN, ê-rōōn', town, Spain, in Guipúzcoa Province, on the left bank of the Bidassoa River (forming the frontier with France) near its effluence into the Bay of Biscay. A port of entry, it lies opposite Hendaye, France, across the river, spanned by an international bridge. The first Spanish railway stop on the Paris-Madrid route (Madrid is 396 miles distant by rail, 298 miles by road), Irún has a large customhouse and transit trade, and is a center of industry (rolling stock, cement, matches, electrical equipment, cider, liqueurs), agriculture (corn, chestnuts, apples, other fruit), and mining (iron, lead). It has an ancient church, rebuilt in 1508 and restored in 1912, and a 17th-century Renaissance-style town hall. Strongly defended by the Loyalists in the Civil War of 1936-1939, it fell to the Nationalists on Sept. 4, 1936. Pop. (1950) 19,452.

IRUS, i'rūs, nickname of Arnaeus, the huge beggar of Ithaca in Homer's *Odyssey*, who served Penelope's suitors as a messenger and was badly defeated by Odysseus in a fist fight. Irus became the prototype of other beggars in literature and was the name of the disguise-changing character in George Chapman's play, *The Blind Beggar of Alexandria* (1598).

IRVIN, William Adolph, American industrialist: b. Indiana, Pa., Dec. 7, 1873; d. New York, N. Y., Jan. 1, 1952. In 1894, Irvin began working for a sheet steel and tin plate manufacturer in Apollo, Pa., and after the firm was absorbed by the American Sheet and Tin Plate Company, he was placed in charge of plant operations in 1924. He moved to New York in 1931 to become vice president of the United States Steel Corporation, whose fourth president he became in 1932. After his retirement from the presidency on Dec. 31, 1937, he helped reorganize the National Safety Council, and from 1942 served as chairman of its board of trustees.

IRVINE, ū'r'vīn, Sir James Colquhoun, Scottish chemist: b. Glasgow, Scotland, May 9, 1877; d. St. Andrews, June 12, 1952. After completing studies at the Royal Technical College in Glasgow and at St. Andrews and Leipzig universities, he became professor of chemistry at St. Andrews, and, from 1921, university principal and vice chancellor. For his outstanding research on the structure of carbohydrates, he was awarded the Davy Medal of the Royal Society in 1925. He was knighted in the same year.

IRVINE, William, American Revolutionary War general: b. near Enniskillen, Ireland, Nov. 3, 1741; d. Philadelphia, Pa., July 29, 1804. After studying medicine with the celebrated physician, George Cleghorn, at the University of Dublin, he served as surgeon aboard a British ship of war during part of the Seven Years' War. In 1764 he emigrated to Carlisle, Pa., where he launched a medical practice.

At the beginning of the Revolutionary War he became a member of the provincial convention assembled in Philadelphia on July 15, 1774. Three years later he was appointed by Congress as commander of the 6th (later 7th) Pennsylvania Infantry Regiment. He was sent with his troops to Canada and in June 1776 was captured by the British during the engagement at Three Rivers. Released through an exchange of prisoners on May 6, 1778, he was promoted on May 12, 1779, to brigadier general in the Continental Army and was assigned to command the 2d Pennsylvania Brigade. In the autumn of 1781, he was ordered to Fort Pitt (Pittsburgh), where he retained command of the troops on the western frontier until October 1783.

Rewarded by Pennsylvania with a generous land grant, General Irvine in early 1785 was appointed state agent in charge of distributing lands to troops of the commonwealth. He recommended that Pennsylvania purchase from the federal government the tract known as the Erie Triangle, and the state's favorable reaction gave Pennsylvania its outlet on Lake Erie.

General Irvine was a member of Congress under the Articles of Confederation (1786-1788) and of the 3d Congress under the Constitution (1793-1795). He commanded the Pennsylvania troops which quelled the Whiskey Rebellion

(q.v.) in 1794, and in 1800 was appointed superintendent of military stores in Philadelphia.

Consult Butterfield, Consul W., ed., *Washington-Irvine Correspondence* (Madison, Wis., 1882); Boyd, Lucinda J., *The Irvines and Their Kin* (Louisville, Ky., 1898; rev. ed., 1908).

IRVINE, city, Kentucky, seat of Estill County, situated in a truck-farming area along the Kentucky River, 38 miles southeast of Lexington. Irvine's manufactures include railroad shops, sawmills, clothing mills, and some oil refining. Pop. 2,955.

IRVINE, burgh, Scotland, situated in north Ayr County about 31 miles southeast (by road) of Glasgow, for which it functioned as a port before the deepening of the Clyde. Irvine's harbor, formed by the confluence of the Irvine and Garnock rivers, was improved in the 1870's, and is used for the shipping of coal, although it is not deep enough for large modern vessels. Principal manufactures include chemicals, foundry products, hosiery, soap, and bottles.

Established as a royal burgh about 1230, Irvine includes among its places of historical interest an academy, whose foundations pre-date the Reformation, and the ruins of Norman castles. Robert Burns worked in Irvine as a flax dresser (1781-1783). Pop. (1951) 14,741.

IRVING, Edward, Scottish preacher and founder of the Catholic Apostolic Church: b. Annan, Scotland, Aug. 4, 1792; d. Glasgow, Dec. 7, 1834. Graduated from the University of Edinburgh in 1809, he taught school for eight years, meanwhile becoming a licensed preacher of the Church of Scotland in 1815. In October 1819, he became Dr. Thomas Chalmers' assistant in St. John's parish, Glasgow, until 1822.

In 1822, Irving became minister of the Caledonian Asylum chapel in Hatton Garden, London. Here the force and eloquence of his sermons, some of which were published in 1823 in *For the Oracles of God*, attracted large congregations. He began, however, to publish unorthodox theological views which were somewhat mystical and prophetic in character and which preached the imminence of Christ's second coming. His *Sermons, Lectures, and Occasional Discourses*, in which his theological divergences were first distinctly observed, was published in 1828, and his tract, *The Orthodox and Catholic Doctrine of Our Lord's Human Nature* (1830), evidencing radical views on the human nature of Christ, soon subjected him to charges of heresy.

In early 1832 his inferences, especially in connection with the so-called "unknown tongues," first heard in March 1830 from the Scottish girl, Mary Campbell, led his congregation, which in 1829 had erected a large church for him in Regent Square, to prefer charges against him. On April 26, 1832, he was removed from his London pulpit, and on March 13, 1833, he was condemned for heresy regarding the sinlessness of Christ by the presbytery of Annan, and deposed from the ministry. Irving retired to Scotland broken in spirit and ill with consumption. With Henry Drummond, a banker, he helped organize in 1832 a Christian community which eventually became the Catholic Apostolic Church (q.v.), whose members were popularly known as Irvingites.

Consult Oliphant, Margaret O. W., *The Life of Edward Irving*, 2 vols. (London 1862); Carlyle, Gavin, *The Collected Writings of Edward Irving*, 5 vols. (London

1864-66); and Drummond, Andrew L., *Edward Irving and His Circle* (London 1937).

IRVING, Sir Henry (original name JOHN HENRY BRODRIBB), English actor-manager: b. Keinton Mandeville, England, Feb. 6, 1836; d. Bradford, Oct. 13, 1905. Employed first as a clerk in London, he made his theatrical debut at the Lyceum Theatre, Sunderland, on Sept. 18, 1856, in the role of Gaston in Bulwer-Lytton's *Richelieu*. For nearly three years he then appeared with an Edinburgh stock company. He first acted in London at the Princess' Theatre on Sept. 24, 1859, and soon moved on to Manchester, where he appeared at the Theatre Royal from 1860 to 1865.

Returning to London in 1866 he created his first outstanding successes as Doricourt in *The Belle's Stratagem* at the St. James' Theatre and as Digby Grant in James Albery's *The Two Roses* (1870), which ran for 300 performances. In 1871 began his long association with the Lyceum Theatre, where he created his powerful impersonation of Mathias in Leopold Lewis' melodrama, *The Bells*, following which he played the title roles in William G. Wills' *Charles I* (1872) and *Eugene Aram* (1873), and in *Richelieu* (1873). In 1874-1875, during a 200-night run at the Lyceum, he sustained the role of Hamlet so successfully that he raised himself to top rank among English actors. He followed with a series of original, if not distinguished, performances as Macbeth (1875), Othello (1876), and Richard III (1877).

In 1878, in association with Ellen Terry (q.v.), with whom he had first appeared in *The Taming of the Shrew* in 1867, he leased the Lyceum, which remained under his management for 21 years. Here he created excellent productions of *Hamlet* (1878), *The Merchant of Venice* (1879-1880), in which he created a dignified and sympathetic Shylock, *Othello* (1881), *Romeo and Juliet* (1882), *Much Ado About Nothing* (1882-1883), and *Macbeth* (1888). Outstanding among his non-Shakespearean performances was his Mephistopheles in Wills' *Faust* (1885-1887), which ran for 16 months to become Irving's greatest financial success.

Henry Irving's appearances in the provinces were equally successful, as were his performances during eight American tours commencing in 1883-1884 and ending in 1903-1904. His Lyceum company, with Ellen Terry, made its debut in New York, with Irving appearing as Mathias in *The Bells*.

Among Irving's last great performances were the title roles in Tennyson's *Becket* (1893, frequently revived), J. Comyns Carr's *King Arthur* (1895), and several plays by Victorien Sardou which were translated by Irving's son, Laurence Irving (q.v.). The latter productions included *Robespierre* (1899), especially written for the English actor; and *Dante* (1903), which was performed at the Drury Lane Theatre.

Although critics were by no means in accord on the merits of his acting, which was somewhat romantic in style and occasionally suffered from excessive gestures and unfortunate mannerisms of voice, most agreed that Sir Henry excelled his contemporaries in his originality, versatility, and vitality, and in his seriousness of purpose. Added praise for his stage managership derived from his elaborate productions and the quality of his supporting casts.

Irving was knighted in 1895, the first actor to be so honored, and was buried in Westminster Abbey on Oct. 20, 1905.

Consult Archer, William A., *Henry Irving, Actor and Manager* (London 1883); Brereton, Austin, *Life of Henry Irving*, 2 vols. (London 1908); Stoker, Bram, *Personal Reminiscences of Henry Irving*, 2 vols. (London 1906); Terry, Ellen, *The Story of My Life* (London 1908); Irving, Laurence H. F., *Henry Irving, the Actor and His World* (London 1951).

IRVING, Henry Brodribb, English actor-manager: b. London, England, Aug. 5, 1870; d. there, Oct. 17, 1919. The elder son of Sir Henry Irving (q.v.), he was educated at Marlborough College and New College, Oxford. After appearing at the Garrick Theatre in Thomas Robertson's *School* in 1891, he was admitted to the bar in 1894, but within a short time gave up law for the stage. In 1894-1895 he played at the Comedy Theatre with J. Comyns Carr, and later in 1895 toured the provinces with Ben Greet's company. He subsequently appeared notably in the lead role of Barrie's *The Admirable Crichton* (1903) and as Hamlet (1905) at the Adelphi.

After 1900 he became one of London's most successful stage managers, as lessee of the Duke of York's Theatre (1902), of the Shaftesbury (1908), of the Queen's (1909-1911), and of the Savoy (from 1913). He toured the United States in 1906-1907, Australia in 1911-1912, and South Africa in 1912-1913.

Irving also wrote several studies in criminology, including *The Life of Judge Jeffreys* (1898), *Studies of French Criminals of the Nineteenth Century* (1901), and *A Book of Remarkable Criminals* (1918).

Consult Brereton, Austin, "*H.B.*" and Laurence Irving (London 1922).

IRVING, Isabel, American actress: b. Bridgeport, Conn., Feb. 28, 1871; d. Nantucket, Mass., Sept. 1, 1944. She made her New York debut as Gwendolyn Hawkins in *The Schoolmistress* in January 1887. From 1888 until 1894, she performed with Augustin Daly's Company, and in 1897 she became a leading lady to John Drew's company at the Lyceum Theatre, where she appeared in *The Liars* (1898), *The Tyranny of Tears* (1899), and other plays. She also acted leading parts in England, creating the role of Lady Jocelyn Leigh in *To Have and to Hold*.

Engaged by Clyde Fitch, she returned to the United States to appear in *The Toast of the Town* (1906) and *Susan in Search of a Husband* (1907). Throughout the next three decades she appeared in a wide variety of roles, including that of Mrs. Dallas-Barker in *Smith*, in which she co-starred with John Drew (1909-1911). Among her final performances were roles in *We Moderns* (1924), *Craig's Wife* (1926-1927), *Uncle Vanya* (1930), and *Three Wise Fools* (1936).

IRVING, John Duer, American geologist: b. Madison, Wis., Aug. 18, 1874; d. France, July 20, 1918. The son of Roland Duer Irving (q.v.), he was graduated from Columbia College in 1896 and later served the United States Geological Survey as assistant geologist (1900-1906) and geologist (1906-1907). From 1907 to 1918 he was professor of economic geography at the Sheffield Scientific School of Yale University. He was editor of the journal, *Economic Geology*, and the author of *Economic Resources of the Northern Black Hills* (1904).

IRVING, Laurence (Sydney Brodribb), English actor: b. London, England, Dec. 21, 1871; d. Canada, May 29, 1914. The younger son of Sir Henry Irving (q.v.), he received his formal education at Marlborough College and the Collège Rollin in Paris. Interested in the diplomatic service as a career, he studied for three years in Russia, but following his debut in a Shakespearian role at Dundee in 1893, he remained on the stage. He made his London debut in Barrie's *Walker, London* in 1894, and then starred in the provinces.

From 1900 to 1904, Laurence performed as a member of his father's company, and soon afterward created the role of Crawshay in *Raffles*. In 1908-1909 he visited the United States, where he acted in several of his own sketches, and in 1912 appeared back in London as Iago in the *Othello* of Sir Herbert Tree's company at His Majesty's Theatre. He lost his life aboard the *Empress of Ireland*, which sank in the St. Lawrence on May 29, 1914.

Irving wrote *Peter the Great* (1897; produced by his father in 1898) and *Richard Lovelace* (produced in New York in 1901), and also translated Maxim Gorky's *The Lower Depths* (1912) and several plays by Victorien Sardou in which his father appeared.

Consult Brereton, Austin, "H.B." and Laurence Irving (London 1922).

IRVING, Roland Duer, American geologist: b. New York, N. Y., April 29, 1847; d. Madison, Wis., May 27, 1888. The father of John Duer Irving (q.v.), he was a graduate of the Columbia School of Mines (1869). Professor of geology and mineralogy at the University of Wisconsin from 1870, he also served as assistant state geologist between 1873 and 1879. From the early 1880's he was geologist in charge of the Lake Superior division of the United States Geological Survey, for which he contributed valuable studies on copper and iron ores in the Superior region.

IRVING, Washington, American author: b. New York, N. Y., April 3, 1783; d. Tarrytown, Nov. 28, 1859. His father, William Irving, a merchant, went to New York from the Orkneys in 1763, having two years before married Sarah Sanders, daughter of Cornish parents. Washington was the youngest of the 11 Irving children, who included William, a poet and politician, and Peter, also a writer. His formal schooling was far from thorough, but he was an enthusiastic reader of English authors.

At the age of 16, Washington entered a law office, and in 1802 began authorship by contributing humorous sketches on social and theatrical life in New York above the signature of Jonathan Oldstyle to *The Morning Chronicle*, a daily edited by his brother Peter. These were independently published in 1802-1803 as *The Letters of Jonathan Oldstyle, Gent.*

Developing symptoms of consumption, he sailed in 1804 for France and spent two health-restoring years in travel on the continent and in England. On his return to the United States he was admitted to the bar, but instead of practicing law he again turned to writing. In 1807, with his brother William and with James K. Paulding, he began issuing a series of charming and witty essays published as *Salmagundi; or, the Whim-Whams and Opinions of Launcelot Langstaff, Esq., and Others* (1807-1808), the success of which settled him on his future career.

At the close of the following year he set about reshaping his burlesque history of New York, which he had begun earlier with Peter Irving on a different plan. In the midst of this work he lost by death in 1809 his fiancé, Matilda Hoffman, daughter of a prominent New York lawyer, in whose office Irving had finished his legal studies. The completion of the book, Diedrich Knickerbocker's *A History of New York from the Beginning of the World to the End of the Dutch Dynasty* (1809), was the only solace that he permitted himself in the first months of grief. This first outstanding American comic chronicle proved to be a brilliant satire on history, politics and government, and manners.

In 1810, Irving was received into partnership by his brothers Peter and Ebenezer, who were founding an importing house. His brothers wished to provide him with the means, without expenditure of his time on business, to continue his chosen career. In 1813-1815, Washington edited or contributed to the *Analectic Magazine*, published in Philadelphia. After the burning of Washington, D.C., by the British in 1814, he offered his services to New York and was made aide-de-camp to Governor Daniel Tompkins, with the rank of colonel. At the close of the war, Irving went to England, where he was received with distinction by the American artists Washington Allston and Charles R. Leslie, and by Sir Walter Scott, Thomas Campbell, Thomas Moore, and other literary men.

In 1818 the firm of Peter and Ebenezer Irving failed, and Washington's pleasant rambles in England and Scotland came to an end, and he set himself to work in London with his writing. Early in the next year he sent over for publication in New York and Philadelphia the first number of *The Sketch Book of Geoffrey Crayon, Gent.*, which, with others that followed, eventually contained *The Voyage, The Wife, Rip Van Winkle, The Legend of Sleepy Hollow*, and other sketches. Successfully received, *The Sketch Book* was brought out in a London edition by John Murray in 1820, and its popularity was such that Murray soon also published *Bracebridge Hall; or, The Humorists* (1822) and *Tales of a Traveller* (1824).

In 1826, Irving went to Madrid at the urging of his friend, Alexander H. Everett, American minister to Spain, who advised Irving to translate the *Colección de los Viajes y Descubrimientos* (of Columbus), by Martín Fernández de Navarrete, then being issued in parts. The American author found the work impracticable to translate because it was a collection of sources rather than a consistent narrative. Instead, he prepared *A History of the Life and Voyages of Christopher Columbus*, finished in 1828. This first serious product of Irving's creative skill succeeded in retaining much of the ease and charm of *The Sketch Book* and of *Tales of a Traveller*, and considerably enhanced his reputation. Further fruits of Irving's Spanish studies and travel were *A Chronicle of the Conquest of Granada* (1829), *Voyages and Discoveries of the Companions of Columbus* (1831), and *The Alhambra* (1832). In the meantime, Irving had been made secretary of the American legation in London in 1829, and received the medal of the Royal Society of Literature (1830) and an I.L.D. degree (1831) from Oxford.

In 1832 he returned to the United States and accompanied an Indian commission to Fort Gibson on the Arkansas River. From his experiences he wrote *A Tour on the Prairies* (1832), published as

the first volume of *The Crayon Miscellany* in 1835. The second volume, *Abbotsford and Newstead Abbey*, and the third, *Legends of the Conquest of Spain*, followed in a few months. He now bought the little van Tassel farm at Tarrytown, N.Y., and began to enlarge its Dutch cottage and improve the grounds. To this home, called "Sunnyside," he and the brothers who had aided him in earlier years soon moved from New York City. In 1836 he finished *Astoria*, with the help of his nephew, Pierre M. Irving, from materials furnished by John Jacob Astor. The next year he published *The Adventures of Captain Bonneville, U.S.A.*, properly a continuation of the preceding. He then began a history of the conquest of Mexico, but on learning that William H. Prescott was at work on the same subject, resigned the task to him. In 1839 he was engaged to write for the *Knickerbocker Magazine*, and furnished monthly articles for about two years. In 1842 he was appointed minister to Spain, and for the next four years wrote little. On his return he arranged with George P. Putnam for a complete edition of his works, in 15 volumes, to which he added *Oliver Goldsmith* (1849) and *Mahomet and His Successors* (1850). The way was now open for the *Life of Washington*, which had long been contemplated. In 1855 appeared *Wolfert's Roost*, mainly a compilation of his early notebooks, and two volumes of the *Life*. The work told on his strength, and the fifth and last volume, finished in March 1859, left him a broken man. His death was from heart disease.

Irving's most salient characteristics as a writer are his romantic affection for the relics and legends of the past and his ability to transmit this feeling to his readers. Bound up with this sensibility is his loving craftsmanship in words, which made him the first "classic" in the literature of the United States. His fatal limitation is a blindness to the spirit of his own time, a failing which kept him a minor writer despite the high order of his artistic skills. The standard edition of his *Works* was published in 21 volumes (1860-61; reprinted in 12 vols., 1881). See also KNICKERBOCKER HISTORY OF NEW YORK, THE; LEGEND OF SLEEPY HOLLOW, THE; SKETCH BOOK, THE.

Consult Irving, Pierre M., *The Life and Letters of Washington Irving* . . . 4 vols. (New York 1862-64); Williams, Stanley T., *The Life of Washington Irving*, 2 vols. (New York 1935).

IRVINGTON, ū'r-vīng-tūn, town, New Jersey, in Essex County, at an altitude of 212 feet, adjoining Newark on the southwest. It is a residential suburb served by the Lehigh Valley Railroad with an industrial section where such varied products as chemicals, insulating material, toy trains, hosiery, cutlery, and metal castings and tools are made. Settled in 1692, it was called Camptown until 1852, when it was renamed in honor of Washington Irving. It was incorporated as a town in 1898, and has commission government. Pop. 59,379.

IRVINGTON, village, New York, in Westchester County, at an altitude of 175 feet. Located on the Hudson River and served by the New York Central Railroad, it is 22 miles north of New York City and immediately south of Tarrytown. A settlement made on the site about 1650 was called Dearman until 1854, when it was renamed for Washington Irving, who had bought

10 acres here called Wolfert's Roost, which he renamed Sunnyside. In the 1880's many rich men lived here: Jay Gould, Cyrus W. Field, the Morgans, Fargos, and Harpers. The Jonathan Odell House (1693) was a Revolutionary War inn. The Children's Museum and Irvington House for Cardiac Children are also located here. Although Irvington is mainly residential, it has several large industries, notably the manufacture of greenhouses and ventilating boilers. The village was incorporated in 1872. Pop. 5,494.

IRWIN, ū'r-wīn, May (real name ADA CAMPBELL), American actress: b. Whitby, Ontario, Canada, June 27, 1862; d. New York, N.Y., Oct. 22, 1938. She made her debut at the Adelphi Theater, Buffalo, N.Y., in 1875, and in 1877 went to New York City, joining Tony Pastor's company, where Augustin Daly discovered her in 1883. For the next four years she was a member of Daly's company, making her mark as a comedienne. She excelled in farce and starred in many successes, from *The Widow Jones* (1895) to *No. 13 Washington Square* (1915), which was performed in Washington for President Woodrow Wilson and his cabinet. She also popularized many hit songs of the day including *After the Ball*, which she sang in *The Poet and the Puppets* (1893), and *A Hot Time in the Old Town in Courted into Court* (1896). She was one of the first to introduce the style of singing known as ragtime. She retired in 1922.

IRWIN, Wallace (Admah), American humorist and novelist: b. Oneida, N.Y., March 15, 1875; d. Southern Pines, N.C., Feb. 14, 1959. Brother of Will Irwin (q.v.), he was brought up in Colorado, attended Stanford University, and in 1900 became a special writer on the San Francisco *Examiner*. In 1904 he moved to New York City, where he wrote for the *Globe* and other publications, working as a free lance writer from 1907. Irwin published more than 20 novels and books of humor and verse, of which the best-known are probably his Japanese dialect stories, notably the *Letters of a Japanese Schoolboy*, begun in *Collier's Weekly* in 1906 and first published in book form in 1909. His novels include *Seed of the Sun* (1921), about the Japanese in California, the result of an assignment for the *Saturday Evening Post* in 1919; *Lew Tyler and the Ladies* (1928); and *Young Wife* (1936). He also assisted Dr. Sylvester M. Lambert of the Rockefeller Foundation in writing *A Yankee Doctor in Paradise* (1941).

IRWIN, Will (in full WILLIAM HENRY IRWIN), American journalist and author: b. Oneida, N.Y., Sept. 14, 1873; d. New York, N.Y., Feb. 24, 1948. Brother of Wallace Irwin (q.v.), he graduated from Stanford University in 1899, entered journalism in San Francisco, and in 1904 went to New York City as a reporter on the *Sun*, for which he wrote his journalistic classic—the story of the earthquake and fire which partly destroyed San Francisco (1906)—published in book form as *The City That Was* (1907). From 1908 he devoted himself to general magazine writing except for the years 1914-1918, when he was a war correspondent for various American publications and the London *Daily Mail*. He also wrote novels and plays, but is best remembered for his reportage. His published works include a volume *The Hamadryads*

(verse, 1904); *Old Chinatown* (1908); *The Confessions of a Con Man* (1909); *The House of Mystery* (1910); *The Red Button* (1912); *Where the Heart Is* (1912); *Men, Women and War* (1915); *The Latin at War* (1916); *A Reporter in Armageddon* (1918); *The Thirteenth Chair*, play, with Bayard Veiler (1916); *The Next War* (1921); *Columbine Time* (1921); *Christ or Mars* (1923); *Youth Rides West* (1925); *How Red is America?* (1927); *Highlights of Manhattan* (1927); *Herbert Hoover—A Reminiscent Biography* (1929); *The House That Shadows Built* (1929); *Lute Song*, play with Sidney Howard (1930); *Propaganda and the News* (1936); *Spy and Counterspy*, with E. V. Voska (1940); *The Making of a Reporter* (1942); *Spies and Saboteurs*, with T. M. Johnson (1943).

ISAAC, ʾīzāk; ʾīzīk, Hebrew patriarch, son of Abraham and Sarah, the name signifying "laughter." According to the Biblical account given in Genesis 17, the birth of Isaac when Abraham was 100 years old and Sarah 90, was the guaranty of the existence of a covenant, in virtue of which, the descendants of Abraham would be a "chosen people" receiving special enlightenment. His life is highlighted in Scripture chiefly through the incidents of the dismissal of Hagar's son, whom Sarah had seen mocking Isaac (Genesis 21); the offering of Isaac as a sacrifice (Genesis 22) which was providentially averted, being only a test of faith and obedience; his marriage to Rebekah, the Aramean in his 40th year (Genesis 24); the birth of the twins Esau and Jacob after 20 years (Genesis 25), their later strife; Isaac's dream and God's promise to him of future enlargement (Genesis 26). The story of his old age is contained in the narration of the growing, open enmity between his two sons which had been foretold before their birth. In anticipation of his own death, Isaac bade Esau bring him some venison to receive his blessing; Jacob urged by Rebekah who had heard Isaac's request, appeared as Esau before the blind father to receive the blessing promised to his brother; and how Esau learned of Jacob's action and Jacob fled from Esau's wrath—are episodes that preserve after thousands of years their dramatic interest, while for the pulpit of all creeds they retain their power. All of the incidents of Isaac's life have become of great importance in metaphorical usage both in sacred and secular literature. At the age of 180 Isaac died at Hebron, cheered by the return of Jacob and his family from Mesopotamia, and was buried by both of his sons in the cave of Machpelah beside Abraham and Sarah (Genesis 35).

The early rabbis in the Midrash make frequent reference to Isaac. His name is made a compound of two Hebrew words denoting "Law was issued." In the Hebrew letters of his name allusion is found to the ten words (declogue), and the respective ages of Sarah and Abraham at his birth. To silence evil tongues on the occasion of Isaac's weaning, Abraham's features were imprinted on his face, so that the likeness between father and son was very great. The sacrifice of Isaac furnishes a fertile field for Midrashic reflection and becomes a special feature of the Jewish liturgy. Christian interpretations sometimes regard it as a prefiguring of the crucifixion. Isaac is stated to have instituted the traditional afternoon prayer and to have had ex-

traordinary attributes. In Mohammedan legend, Ishmael appears substituted for Isaac as offering and other points of similarity with the rabbinical Midrash are to be observed.

ISAAC I COMNENUS, Byzantine emperor: d. 1061. He was the son of Manuel Comnenus (q.v.) an eminent general under Basil II, emperor of Constantinople, and was the first of his family to assume the purple. He had distinguished himself as a soldier and commander in the wars against the Arabs, in Asia Minor and had married a captive Bulgarian princess. In 1057 he succeeded to the throne upon the deposition of the aged and incompetent Michael VI. During his short reign he made many reforms which are credited with prolonging the empire. His financial measures, though they improved conditions, were extremely unpopular. He also strengthened the empire by successfully repelling the Hungarians and Petchenegs who had been threatening the northern borders (1059). He abdicated in 1059 on account of sickness, appointing a relative, Constantine Ducas, as his successor. He spent the remainder of his life in the monastery at Studion where he had received his education as a youth. His interests were not purely military or political; he left a manuscript, still in existence, on Homer, entitled *Scholion*. He also wrote two other works on the same subject *Characteristics* and *On the Works of Homer*.

Consult Gibbon, E., *History of the Decline and Fall of the Roman Empire*, vol. 5 (London 1898); Finlay, G., *History of the Byzantine and Greek Empires, 1057-1453* (Edinburgh 1854); id., *History of Greece*, vols. 2, 3, 4 (Oxford 1877).

ISAAC II ANGELUS, Byzantine emperor: d. 1204. He became sovereign of the East as successor of Andronicus I in 1185, by a revolution, and reigned 10 years. During his rule the empire suffered several unsuccessful military campaigns and the excessive taxes caused the revolt of the Bulgarians and Vlachs (1186). After promising free passage through his empire to the crusaders under Frederic I Barbarossa (q.v.) of Germany, he treacherously formed an alliance against them with Saladin (q.v.) but was compelled to keep his promises through force of arms. Isaac was a vicious and weak prince. He was dethroned, blinded, and imprisoned by his brother Alexius in 1195. Eight years later he was restored to the throne, reigned for six months (1203-1204), was again dethroned and soon after died in prison.

Consult Gibbon, E., *History of the Decline and Fall of the Roman Empire*, vol. 5 (London 1898); Finlay, G., *History of the Byzantine and Greek Empires, 1057-1453* (Edinburgh 1854); id., *History of Greece*, vols. 3, 4 (Oxford 1877).

ISAAC, ē'zā-āk; ē'zāk, Heinrich, Flemish composer: b. probably in Brabant or East Flanders about 1450; d. Florence, Italy, 1517. Summoned to Florence by Lorenzo de' Medici about 1480, he succeeded Antonio Squarcialupi as court organist, and set many of Lorenzo's carnival songs to music. In 1496, after the fall of the Medici, he entered the service of Emperor Maximilian. One of the great musicians of his day, he composed both secular and sacred works.

ISAAC OF ANTIOCH, ʾīzāk, Syrian churchman: b. probably at Edessa, early in the 5th century. He removed to Antioch about 450 A.D. and for very many years was abbot of a monastery near that city. Many of his works are lost, but about 190 extant metrical

homilies are attributed to him. Of these, some are certainly the work of another Isaac. See also SYRIAC LANGUAGE AND LITERATURE—*Literature*.

ISAACS, ê-sâks'; ê-sâ'âks, **Jorge**, Colombian novelist: b. Cali, Colombia, April 1, 1837; d. Ibagué, April 17, 1895. He was the son of a British Jew from Jamaica who married the daughter of an officer in the Spanish Navy. Isaacs first went to school in his native town, and at 11 was sent to Bogotá, where for five years he studied at various schools. These early years of his life are faithfully recaptured in the opening section of his sentimental *Maria* (published in 1867), one of the most widely read novels in Spanish America. Instead of going abroad to study medicine, however, as he wished to do—and as the hero of his novel does—he joined the army and became something of a hero himself. In 1856 he married, and soon after was engulfed in the seething political and military life of his country. The death of his father in 1870 forced him to face new and exacting responsibilities, and the failure of his father's business left him with his poetry and *Maria* as his only assets; however, the numerous editions of his novel never brought him much return in royalties. When the first edition of *Maria* was published, the distinguished Mexican author Ignacio Manuel Altamirano hailed it as superior to anything by René de Chateaubriand, a recognized leader in the French romantic movement; it was serialized in the *Monitor Republicano* in Mexico; and later in Argentina in the *Revista de Argentina*.

Appointed consul to Chile in 1872, Isaacs contributed articles and poems to Argentine, Chilean, and other publications throughout Latin America. Despite his growing renown, however, he felt homesick, and in November 1872 he returned to Colombia where, with a Chilean friend, he bought the hacienda Guayabonero in the Cauca Valley and for two years devoted himself unsuccessfully to agriculture. The last two decades of his life found Isaacs again active in war and politics, but without adding any peace, wealth, or sweetness to his bitter chain of disappointment and poverty.

In *Maria*, Isaacs' approach is basically romantic. His major theme is the deep and pure love of two young people (Efraín and María), which is blocked by the menace of an incurable disease (the epilepsy to which María is subject), and the opposition of Efraín's kind but severe father, who is also María's foster father. Such romantic embellishments as African interludes and sinister ravens lend touches of Mme. de Staël and Edgar Allan Poe to the style and suffuse the "noble savage" passages (idealizing the Negro and condemning slavery) with a honeyed sweetness and remoteness from reality reminiscent of Chateaubriand's *Atala*.

But this is only one side of Isaacs. He also excelled as a *costumbrista* or genre writer, skilled in sketching the scenes in which many of the events of his story occurred. If the love story of his novel is feeble and static, this is compensated for by the vividness of many secondary elements; among them are convincing descriptions of nature, and minor characters filled with the wisdom and humor of simple countryfolk, many of whom make fleeting but unforgettable appearances in the narrative. For example, modern readers will find more life, more flesh and

blood reality, in Salomé, a minor character occupying a few pages, than in the heroine, who, by contrast, seems pallid and unsubstantial.

Consult Arias, A., *Jorge Isaacs y su María* (Quito 1937); Carvajal, Mario, *Vida y pasión de Jorge Isaacs* (Santiago de Chile 1937); Velasco Madriñán, L. C., *Jorge Isaacs, caballero de las lágrimas* (Cali 1942); Anderson Imbert, Enrique, *Prologue to María* (Mexico 1951); Flores, Angel, *Historia y Antología del Cuento y la Novela en Hispanoamérica* (New York 1959).

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ISAACS, Rufus Daniel. See READING, 1ST MARQUIS OF.

ISABEAU, ê-zä-bô', or **ISABELLA** or **ELIZABETH OF BAVARIA**, queen of France: b. 1370; d. Sept. 24, 1435. She was the daughter of Stephen II, duke of Bavaria. In 1385 she was married to Charles VI, king of France, and was crowned with him on Aug. 24, 1389. When the king became subject to attacks of insanity (1392-1422), she acted as regent. Frivolous and vacillating, she became involved in scandalous intrigues, and worked solely to advance her own interests, sometimes siding with the Armagnacs and sometimes with the Burgundians. She was held prisoner by the Armagnacs in 1417, first at Blois, then at Tours. When liberated by John the Fearless, duke of Burgundy, she went completely over to the side of the Burgundians and the English. She was held mainly responsible for the Treaty of Troyes (1420), by which France was surrendered to the English and the right of her son to the crown of France was set aside in favor of Henry V of England, who married her daughter, Catherine of Valois. Her daughter Isabella of France married Richard II of England. Hated by the French for her part in the Treaty of Troyes, Isabeau lived at Paris, lonely and impoverished, until her death, when her son, who, with the help of Joan of Arc, had become Charles VII of France, had her body privately interred in the abbey at St. Denis.

ISABELA, ê-sä-vä'lä, province, Republic of the Philippines, in northeastern Luzon Island. It is the second largest province with a land area of 4,069 square miles. The Sierra Madre Mountains parallel its coast, which borders the Philippine Sea on the east. The Cagayan River flows north through the central part of the province. An important tobacco-growing region, it also raises rice, sugarcane, cacao, coffee, and corn. Two north-south highway arteries link Isabela with Cagayan Province on the north and Nueva Vizcaya Province on the south. There is daily air service to Manila and to Cauayan on Negros Island. Since 1950, about 50,000 acres in new reservations have been opened for land distribution, and an irrigation project is under way to reclaim an additional 58,000 acres. The province has a population (1948) of 264,495. The capital is Ilagan, pop. (1948) 35,384. Aparri, in Cagayan Province, is Isabela's port of entry.

ISABELA, municipality, Republic of the Philippines, in central Negros Occidental Province on Negros Island. It is in an area raising rice and sugarcane, and its chief industry is sugar milling. Binalbagan is nine miles to the west. Pop. (1948) 33,743.

ISABELLA I, ĭz-ă-bĕl'ă (called ISABELLA THE CATHOLIC; Span. ISABEL LA CATÓLICA), queen of Castile; b. Madrigal, Old Castile, April 22, 1451; d. Medina del Campo, Nov. 26, 1504. She was the daughter of John II of Castile and his second wife, Isabella of Portugal. She was married to Ferdinand II of Aragon in 1469. Upon the death of her brother, Henry IV of Castile, whose daughter Juana la Beltraneja was adjudged illegitimate, she herself became queen of Castile in 1474, and the two kingdoms of Aragon and Castile were brought together although they continued to be governed separately; both sovereigns were present at the transaction of state affairs for both kingdoms, and public ordinances of both kingdoms were signed by both Ferdinand and Isabella. Pope Innocent VIII conferred on the rulers the title of "Most Catholic," and Pope Alexander confirmed the title. Under their rule numerous reforms were made in political and ecclesiastical affairs, schools were established, and learning and the arts were developed. The Moorish kingdom of Granada was conquered in 1492, and the same year, under the special patronage of Isabella, Christopher Columbus made his first voyage to America, opening the way for Spain's colonial power in the New World. Less commendable was the establishment of the Inquisition (see INQUISITION—*The Inquisition in Spain*) as an instrument of political control. Isabella had great intelligence and a broad political vision, and her high moral character and sincere piety exerted a strong elevating influence on the Spanish court. In her reforms she was aided by her confessor, Francisco Jiménez de Cisneros. See also FERDINAND V, King of Castile; SPAIN—15. *History: 5th Century A.D. to 1492* (Development of the Christian States: Unification of Spain).

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ISABELLA II (in full MARIA ISABELLA LOUISA), queen of Spain: b. Madrid, Spain, Oct. 10, 1830; d. Paris, France, April 9, 1904. She was the elder daughter of Ferdinand VII and his fourth wife, Maria Christina of Naples, and was declared heir to the throne in June 1833. She succeeded her father the following September, the Salic law having been set aside in 1830. Her mother acted as regent until 1840. The early years of the reign were disturbed by the First Carlist War (1833–1840), led by Isabella's uncle Don Carlos, who under the Salic law would have succeeded to the throne. In 1841, Gen. Baldomero Espartero became regent, but was overthrown by the Carlists in 1843, and Isabella was declared of age. In 1846 she married her cousin Francisco de Asís. Her reign was marked by continual party strife and frequent cabinet changes, and finally culminated in 1868 in an insurrection which forced her from the throne. In June 1870 she abdicated in favor of her son Alfonso XII. See also SPAIN—16. *History: 1492–1931* (Reign of Isabella II).

ISABELLA, the heroine of William Shakespeare's play *Measure for Measure* (q.v.), one of Shakespeare's noblest characters. She is a

novice in Vienna whose brother Claudio, under the strict laws of the city, has been condemned to death for seduction. Isabella pleads for his life with the self-righteous Angelo, who is acting as governor in the duke's absence, and he offers to spare Claudio in return for her honor. The duke, who has remained in Vienna in disguise to check upon Angelo's actions, arranges for her to pretend to accede, her place being taken by Mariana, Angelo's slighted fiancée. In spite of Isabella's supposed compliance, Angelo treacherously arranges to have Claudio executed, whereupon the duke confronts him. Angelo is spared from punishment upon Isabella's intercession and marries Mariana, and the duke declares his love for Isabella.

ISABELLA, (in full ISABELLA, OR THE POT OF BASIL), a narrative poem in ottava rima stanzas, written by John Keats and telling the story of the fourth novel of the fifth day in Giovanni Boccaccio's *Decameron*. It is the only completed part of a projected series of tales from the *Decameron* to be written by Keats and his friend John Hamilton Reynolds. It was begun in February 1818 and completed in April, and represents the chief transition in Keats' work between the *Endymion* of 1817 and the great poems that began in the autumn of 1818.

Isabella is a maiden of Florence who loves Lorenzo, a poor servant of her two cruel and proud brothers. These brothers, learning of her love, kidnap and murder Lorenzo and bury his body in a forest. Lorenzo's ghost appears to Isabella, who digs up the body, cuts off the head, and buries it in a flowerpot with a basil plant growing in it. The pot is stolen by her brothers, and Isabella dies of grief and madness.

Though not fully mature Keats, the poem has always been a favorite with Keats' readers. Charles Lamb asserted that there was nothing "more nakedly grand and moving in sentiment, in Dante, in Chaucer, in Spenser" than the scene of the digging up of the body; Leigh Hunt pointed out the felicity of the phrase "the two brothers and their murder'd man" (that is, the man they were planning to murder); Bernard Shaw, among others, called attention to the powerful tone of social protest in the characterization of the haughty brothers. Keats himself took a more detached view of the poem, saying in a letter to Richard Woodhouse (Sept. 21, 1819) that he would not publish it because "there is too much inexperience of life and simplicity of knowledge in it." But it was finally published in *Lamia, Isabella, The Eve of St. Agnes, and Other Poems* (1820).

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ISABELLITA. See BUTTERFLY FISHES AND ANGEL FISHES.

ISABEY, ĕ-ză-bă', Jean Baptiste, French portrait and miniature painter: b. Nancy, France, April 11, 1767; d. Paris, April 18, 1855. He began his art training in Nancy, and in 1785 went to Paris, where he studied with Jacques Louis David and soon became famous as a portrait painter and miniaturist. His portraits of Napoleon are considered especially fine. The Louvre has many examples of his works in oil, crayon, water color, and on porcelain. Among them are

the 32 drawings of the *Coronation of Napoleon* (1804); *Stairway of the Louvre* (1817), a water color on ivory, considered a masterpiece; and the famous *La table des maréchaux*, painted on Sèvres porcelain, showing Napoleon I and his generals.

His son and pupil, EUGÈNE LOUIS GABRIEL ISABEY (1804–1886), became a marine and genre painter. Several of his paintings are in American museums, among them *The Banquet Hall* (The Metropolitan Museum of Art, New York City); *View of a Port* (Boston Museum of Fine Arts); *Sea Storm* (Chicago Art Museum); *Church Interior* (Baltimore).

ISAEUS, i-sē'ūs, Athenian orator: b. Chalcis, Euboea, about 420 B.C.; d. about 350 B.C. Little about his life is known, except that he was a pupil of Isocrates and a teacher of Demosthenes. Ranked among the so-called Ten Attic Orators, Isaeus owes his fame not to the delivery of his own orations, but to the composition of speeches for his clients to use in pleading their cases in law courts. By this work and by training aspiring orators he seems to have earned his living. Of 64 orations attributed to Isaeus—although even in antiquity only 50 were considered authentic addresses—there survive 11 on contested inheritances, 1 on civic rights, 44 titles of other speeches, 32 fragments of these, and 9 unidentified fragments. Apart from the addresses on the Attic law of succession to estates, in which subject Isaeus is our acknowledged authority, his other orations covered a variety of legal cases concerned with such matters as real property, adoption, guardianship, sureties, assault and battery, and municipal rights. Isaeus' renown for his cleverness in making the worse cause appear the better case is probably the strongest testimony payable to his skill in presentation of such intricate controversies as disputes over dispositions of inheritances often involve. His diction is so simple, his style so lucid, and his exposition so efficient, that the most complicated case becomes quite clear to the modern reader. The best Greek edition with English translation of his speeches is by Edward S. Forster, *Isaeus* (London and New York 1927).

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ISAIAH, i-zā'yā; i-zī'ā, Hebrew prophet of the 8th century B.C. The Hebrew name of the great prophet, Y'sha'yahu or Y'sha'ya, is derived from two words meaning "salvation of Yahweh." In the history of prophecy, Isaiah belongs with Amos of Tekoa and Hosea ben Beeri, both of whom carried on their prophetic activity in the northern kingdom of Israel, and Micah of Moresheth, his southern contemporary. Isaiah was the son of Amoz, of whom nothing is known, and was a married man. His wife is called a prophetess (Isaiah 8:3), but this must not be taken to mean that she followed a prophetic calling. Two sons were born to him, both of whom bore names symbolizing the imminence of divine judgment upon Israel: Sh"ar-yashub (Shear-yashub), "(only) a remnant shall return," and Maher-shalal-hash-baz, "hastening to spoil, speeding to prey." For more than 40 years he was active as Yahweh's prophet in the southern kingdom of Judah. It is possible that he belonged to the aristocratic class; his style and manner seem to be those of an educated person. More

than any other prophet, his work is associated with the city of Jerusalem and the royal court. According to a late apocryphal tradition he suffered a martyr's death by being sawed asunder (consult the pseudepigraphic *Ascension of Isaiah*; compare the Ethiopic version with Hebrews 11:37).

Isaiah prophesied during the reigns of Jotham (742–735 B.C.), Ahaz (735–715 B.C.), and Hezekiah (715–687 B.C.). It was a period of great international conflict in which the military power of Assyria played a central role. The prophet's oracles are in general to be understood against the background of the successive crises evoked by Assyria's invasions of the Mediterranean littoral. His call came to him in the year 742 B.C., when Tiglath-pileser III or Pul (r. c. 745–727 B.C.) threatened Israel and exacted a heavy tribute from Menahem (II Kings 15:19). In his vision Isaiah sees Yahweh seated on His throne in the heavenly assembly, receives his commission to prophesy to "this people" (meant contemptuously), and then hears the terrible words of judgment (Isaiah 6:9–12). During the Syro-Ephraimitic war (734–733 B.C.) he warns Ahaz against entangling alliances and an appeal to Assyria (chaps. 7; 8; 17:1–11). Some of his most stirring oracles were delivered on the eve of Samaria's destruction in 722 B.C. (chaps. 9: 8–10:4; 5:25–30; 28:1–4). At the time when Sargon II (r. 721–705 B.C.) laid siege to Ashdod, Isaiah went through the streets of Jerusalem for three years naked and barefoot in order to symbolize the imminent fall of Egypt. Many oracles are preserved from the period of the invasion of Sennacherib about 705 B.C. (chaps. 10:5 ff.; 14: 24–32; 17:12–18:6; 22; 28:7–29; 30:1–17 and 27–33). The Messianic oracles are among the most notable and influential of all the prophet's utterances (chaps. 9:1–7; 11:1–9; 32:1–8). They are a vivid reflection of the royal theology associated with the house of David. It is significant that Isaiah has nothing to say about the Exodus, and next to nothing about the covenant.

Isaiah speaks with a vigor and eloquence matched by no other Old Testament prophet. His language is rich in imagery; his style chaste and stately. The variety of his allusions and his rhetorical devices reveal a mind of great versatility. The diversity of situation and intent finds expression in many literary forms and types. He uses the refrain effectively, as in the poem on the day of Yahweh (chap. 2:6–19) or that on the fall of Samaria (chaps. 9:8–10:4; and 5: 25–30). Like his compatriots he has a remarkable feeling for assonance, as his alliterations, paronomasias, and repetitions illustrate. His parable of the vineyard (chap. 5:1–7) is a superb example of his literary powers; its construction is firm, its repetition moving, its transition powerful, its climax shattering. His language is always consistent with the message he seeks to convey. Nowhere do we have a sense of labored speech; rather, his words flow forth in a way that seems inevitable.

The two pillars of the prophet's theology are Yahweh's kingship and holiness. As king, God is exalted over all the earth; He rules in majesty and power, though sometimes hidden (chap. 8:17). The final determinative force in history is His activity and sovereignty over events. His word goes forth, and events follow one another until His work is accomplished (chap. 9:8 ff.). Like his later successor, Second Isaiah

(chaps. 40-55), Isaiah is aware of the domination of the divine purpose in history (chaps. 14:24-27; 28:23 ff.). Assyria is the rod of God's anger, but in her vaunting and pride Yahweh of hosts will bring her down. Yahweh is the Holy One of Israel, and His holiness manifests itself not only as luminous power but in justice and righteousness. He has His day, and in the day of His appearing He will bring down all the temporal forces and powers which exalt themselves: *Yahweh alone will be exalted in that day*. Isaiah can be as trenchant in his condemnation of social evils as is Amos. Nor does he spare the worship of the people (chap. 1:10-17), but exposes the insincerity and corruption with which they say their prayers, offer their sacrifices, or celebrate their festivals. Yet there is hope for the remnant through whom Yahweh will fulfill His purpose. Again and again Isaiah calls the men of Judah to live by faith in God; to depend utterly upon Him in the midst of national crisis; for example (in free translation): *If you will not have faith, surely you will not stand firm* (chap. 7:9b); *He who has faith will not be in haste* (chap. 28:16b). The time will come when a king will reign in righteousness, the dawn of a new age of peace, *for the earth will be full of the knowledge of Yahweh, as the waters cover the sea* (chap. 11:9b). See also ISAIAH, BOOK OF.

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ISAIAH, Book of, book of the Old Testament attributed to the prophet Isaiah (q.v.) although it includes prophecies by Second Isaiah and by other successors.

The prophets of ancient Israel were first of all speakers, and the oral nature of their oracles is stamped indelibly upon them. They address their contemporaries with "Thus says the Lord," or "The Lord said to me," or "These are the words which the Lord has spoken." It was only later that their words were written down and compiled. It is possible in some instances that the prophet had a hand in the formation of such "books," but by and large it was his disciples who preserved the traditions associated with their master. In some cases the compilation was prepared within a relatively short time after the words were spoken; in other cases it may have been many years. Other materials were later added which were believed to belong to the same prophetic tradition; thus we encounter considerable diversity in style and terminology and even of thought within the same book. We have an excellent illustration of this process in the Book of Isaiah. To the Isaianic corpus were added the poems of Second Isaiah or Deutero-Isaiah (Isaiah 40-55), which actually come from a period two centuries after Isaiah, the prophet of the 8th century B.C., because it was felt that he was perpetuating the same tradition as his predecessor. In these poems we have the same stress upon Israel's Holy One, upon the kingship of Yahweh, and upon His purpose in the forward movement of history. Then, later, following the same tradition, the prophecies of the successors of Second Isaiah were added (chaps. 56-66). The final stage of the book was a product of the exilic or post-exilic period. Similar processes are reflected in some of the other prophetic books, where the same general ordering of materials is seen.

The four great corpses—Isaiah, Jeremiah, Ezekiel, and the Book of the Twelve (the Minor Prophets)—are all compilations; indeed, they are in some instances compilations of compilations. The first task of the modern student, therefore, is to disintegrate the various collections in order to arrive at the original literary units. Then he must seek to establish the date and provenance of each unit, its literary type and form, and the purpose and nature of the passage. Finally he must endeavor to interpret it in the light of the historical situation in which it was first addressed to the men of Israel. Such an undertaking is the scientific approach to an ancient historical document, but it is also the appropriate way of dealing with a divine revelation which professes to be historical, a revelation relevant to a particular time and a particular people. It is obvious that the results of such an operation as we have been describing will present us with a book quite different from the one which appears in the Bible, for the materials will often be radically reordered to conform to the historical development of the literature.

As we have it before us today, the Book of Isaiah falls into three general divisions: (1) chapters 1-35; (2) chapters 36-39; (3) chapters 40-66.

The first of these divisions contains five sections: (1) chapters 1-12; (2) chapters 13-23; (3) chapters 24-27; (4) chapters 28-33; (5) chapters 34-35.

The third division has two sections: (1) chapters 40-55 and (2) chapters 56-66.

First General Division.—Section 1, Chapters 1-12.—The original nucleus of this compilation is Isaiah 6:1-9:7. It opens, like the books of Jeremiah and Ezekiel, with an account of the prophet's call (chap. 6), and is followed by a series of episodes dealing with the Syro-Ephraimite crisis (734-733 B.C.). Chapter 9:1-7 is denied Isaiah by many scholars; others assign it to a late period in his life. More recently, however, the tendency has been to accept it as genuine and to interpret it against the background of the ideology of the sacral kingship. The collection is certainly Isaiah's and may have circulated for a time as an independent collection. To this book were added the poem on the day of Yahweh (chap. 2:6-19), perhaps at a very early period; also chaps. 9:8-10:4 and 5:25-29, a remarkably vivid series of strophes concerning the imminent destruction of Samaria (722 B.C.); chap. 5:1-7, the song of the vineyard; chap. 5:8-24, invectives and threats. Chapter 1 is a gathering together of diverse materials, and verses 2-3 form an excellent introduction to the prophecy as a whole. Chapter 12, on the other hand, is a late eschatological hymn, probably placed in its present position for liturgical purposes.

Section 2, Chapters 13-23.—These chapters are distinguished by the word *massa'*, which appears some 10 times as a superscription. It is usually rendered "burden," or, in the Revised Standard Version (RSV), "oracle." Many of the oracles are addressed to the foreign nations—Babylon, Moab, Damascus, Egypt, and others. Much of the material does not belong to Isaiah. Among the materials which may be assigned to the prophet are chap. 14:24-27, the removal of the Assyrian yoke; chap. 14:28-32, an invective on the Philistines; chap. 17:1-11, the fall of Damascus (732 B.C.); chapter 19, a symbolic prophecy against Egypt; and chapter 22, two

utterances from different periods. The date of the collection as a whole is the postexilic period.

Section 3, Chapters 24-27.—This section is sometimes called "the little apocalypse." It is composed of eschatological prophecies (chaps. 24:1-3, 17-23; 25:6-8; 27:1, 12-13) and poems (compare the eschatological hymn of 25:1-5, 9-12). In vivid pictures it portrays the end of things, the threat of world destruction with the return of primeval chaos, and a prediction of the return of the Diaspora. While there is no general agreement as to the date of the section, it is certainly late, perhaps as late as the 4th century B.C. The attempt to date it in the late 2d century B.C. is shattered by its presence in the Isaiah manuscripts among the Dead Sea Scrolls (see *SCROLLS, THE DEAD SEA*).

Section 4, Chapters 28-33.—Like chapters 1-12, this section contains a considerable amount of genuine Isaianic material. Among the passages which have the best claim to authenticity are the following: chap. 28:1-22 (verses 1-4, an invective against Samaria; verses 7-22, an invective against priests and prophets); chap. 28:23-29, Yahweh's instruction to the farmer; chap. 29:1-8, beginning with "Ho Ariel, Ariel" (RSV), a threat expanded by a later promise; verses 9-15, three originally independent invectives; chap. 30:8-14, an invective and threat opening with the instruction to Isaiah to inscribe his words in a book "as a witness for ever" (RSV); chap. 31, directed to those who go to Egypt for help. This compilation is usually styled the anti-Assyrian cycle because with few exceptions all the oracles come from the anti-Assyrian period of 713-701 B.C. Following Hermann Gunkel, many interpret chap. 33 as a liturgy composed of different literary types.

Section 5, Chapters 34-35.—The two chapters are counterparts to each other, the one describing the destruction of Edom, the other the felicity of Zion. The theme of both is eschatological. It is held by some scholars that they were placed here as a conclusion to chaps. 1-33; others, like Charles Cutler Torrey, believe that they belong with chaps. 40-56 but have been separated from them by the narrative section (chaps. 36-39) in order to weave chaps. 1-33, 34-35, and 40-56 into a single book.

Second General Division.—Chapters 36-39.—This division is drawn from II Kings 18:13-20:19, although in a somewhat altered form. It has been inserted by the final compiler in order to include all materials associated with Isaiah. The psalm of Hezekiah (Isaiah 38:9-20) has been added to the tradition from Kings. The rest of the material belongs to the characteristic type of prophetic narrative (compare the Elijah narratives).

Third General Division.—Section 1, Chapters 40-55.—The section forms a literary unit composed, to be sure, of a number of separate poems. The dominating theme is eschatological. Yahweh is about to appear in history in a mighty act of redemption. The "prologue" takes place in the heavenly assembly where the great event is first announced (chap. 40:1-11). All the major themes of the sacred past are brought to bear upon the interpretation of the events that are now about to happen. The Servant of the Lord plays a role of central importance throughout, culminating in the poem on the Suffering Servant (chaps. 52:13-53:12). In many passages it is certain that the servant is Israel; in others (as in chaps. 40:1-

4; 42:1-6; 52:13-53:12; 55:4-9) there is disagreement as to the identification. Many believe he represents an individual; others identify him with Israel, as in the other poems. The section is to be dated about 550-538 B.C., the end of the Babylonian age.

Section 2, Chapters 56-66.—These poems have many striking affinities with Second Isaiah; for this reason a number of scholars believe that they are of the same authorship. A more probable view is that they were composed by Second Isaiah's disciples and followers. The eschatology of the section is more advanced, the literary style is often different, and the theology reflects a greater interest in the cultus. Chapter 56:1-8 is a prophetic torah concerning the admission of foreigners and eunuchs to the temple community; chaps. 56:9-59:21 consist of rebukes to several classes, interspersed with promises for fidelity; chaps. 60-62 describe the New Jerusalem; chap. 63:1-6 tells of the divine hero in Edom; chaps. 63:7-64:12 deal with confession; chaps. 65-66 set forth the contrast between the faithful and the apostates.

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ISAR, ē'zār, river, Germany, in Bavaria. It rises just north of Innsbruck, Austria, and flows generally north and northeast in Bavaria for about 163 miles, through Munich and past Landshut, to join the Danube near Deggendorf.

ISAROG, ē-sā-rōg', extinct volcanic mountain peak in the Philippines, on Luzon Island, in Camarines Sur Province, 10 miles east of Naga. It is 6,482 feet high. Sulphur is mined on it.

ISAURIA, i-sō'ri-ā, an ancient district of southern Asia Minor, bordering ancient Pisidia and Cilicia. It lies north of the Taurus Mountains, in what is now south-central Turkey. It was a wild region where wandering tribes lived by plunder. Partially subdued by Rome in the 1st century B.C., it was never entirely conquered until the arrival of the Seljuk Turks in the 11th century A.D. Two Isaurians became Byzantine emperors, Zeno (r. 474-491) and Leo III (r. 717-741).

ISCHIA, ĭs-kĭ-à, It. ěs-kyä (anc. PITHECUSAE and AENARIA), island, southern Italy, in Campania, near the northern entrance to the Bay of Naples. A channel eight miles wide, in which lies the island of Procida, separates Ischia from Cape Miseno (q.v.) on the mainland. The island, about five miles long and four miles wide, covers an area of 18 square miles. The coast is deeply indented and the terrain mountainous, reaching the highest point (2,588 feet) in Mount Epomeo. Ischia is of volcanic origin and suffered from severe eruptions, the last one in 1301 or 1302. Strictly connected with the past volcanic activity are the numerous warm mineral springs and the frequent earthquakes—the worst one in 1883 practically destroying Casamicciola (q.v.). Ischia has been a favorite resort since Roman times, because of the therapeutic value of its mineral springs, and because of its equitable climate, luxuriant vegetation, and enchanting scenery. Catering to tourists, cultivating grapes and other fruit, and wine processing are the chief occupations. The principal towns are Ischia (11,416), Forio (7,209), and Casamicciola (4,983). On a small islet off the town of Ischia stands an imposing medieval castle and along the coasts are towers erected as a defense against Turkish pirates who ravaged the island during the 16th century. Pop. (1961) 34,213.

ISEO, Lago d', ě-zâ-ô (anc. SEBINUS LACUS), lake, northern Italy, in the Alpine foothills of Lombardy, at an altitude of 610 feet. It is formed by the Oglio River that enters in the north and leaves from the south. Long and narrow, the lake has an area of 23.5 square miles, a length of about 15 miles, a maximum width of 3 miles, and a maximum depth of 820 feet. The western shore is in the Province of Bergamo, the eastern shore in the Province of Brescia. In the center of the lake is an island, Monte Isola (Montisola). The shores are covered with olive groves and the waters abound in fish. Towns on its shores are Lovere and Pisogne in the north, and Iseo and Sarnica in the south.

ISÈRE, ě-zâr', department, France, in the southeast, part of the old province of Dauphiné, bounded north and west by the Rhone, east by Savoy, and south and southeast by Drome and Hautes Alpes. Its area is 3,178 square miles, about 50 percent of which is arable and 20 percent forest land. The surface is level in the north, but becomes very mountainous toward the south, where the scenery is magnificent. It is drained by the Rhone, and its tributary streams, the Isère, Drac, and Romanche. The department is rich in minerals. Coal, iron, lead, silver, gold, and marble are mined and the forest products are of importance. Gloves, paper, and silk are manufactured. Grenoble is the capital. Pop. (1962) 729,789.

ISÈRE RIVER, river, southeast France, which takes its rise in Savoy at the foot of Mount Iseran, flowing generally southwest through Savoy and through the departments of Isère and Drome, and joining the Rhone about six miles above Valence. Its entire length is about 190 miles, for the last 70 of which it is navigable.

ISERNIA, ě-zĕr'nyâ, town, southern Italy, in Campobasso Province, Abruzzi e Molise, 23

miles west of Campobasso. Wool textiles and lace are the chief products. Landmarks include ancient walls, a Roman aqueduct, and a cathedral (1837). A Samnite town, it flourished as a road center in Roman times. Pop. of the commune (1961) 12,781.

ISFAHAN, ĭs-fâ-hân', Iran, city 210 miles south of Teheran, former capital of the country. It is situated in the midst of an extensive plain watered by the Zaindeh Rud. At the heart of the city is a great square known as the Maiden-i-Shah, formerly encircled by a canal. Notable buildings still standing include a royal mosque built by Shah Abbas I, the royal palace, and a lofty archway which leads into magnificent gardens. The principal industries of the city include the manufacture of carpets, woolen and cloth textiles, and matches. There is also an extensive trade in leather goods, silver filigree work, and lacquered products. The city is the center of the activities of the Church Missionary Society (of the Anglican Church) and of Iranian adherents of the Roman Catholic Armenian rite.

Known to the ancients as *Aspadana*, the city reached its greatest prosperity under Shah Abbas I—early in the 17th century. Jean (later Sir John) Chardin (q.v.), who resided at Isfahan from 1664 to 1681, reported that the walls were 24 miles in circuit and contained 162 mosques, 48 colleges, 1,802 caravansaries, and 273 public baths. After the Afghans captured Isfahan in 1722 the capital was removed to Teheran; although soon retaken by Nadir Shah the city declined gradually in importance. During World War I, the Russians occupied it for a short period in 1915–1916 and then were replaced by a British force. Pop. (1960) 246,600.

Consult Lockhart, L., *Famous Cities of Iran* (London 1939).

ISHAM, ĭ'shâm, Samuel, American painter and writer: b. New York, N.Y., May 12, 1855; d. Easthampton, June 12, 1914. After graduating at Yale University in 1875 he studied law, but turned to painting after admission to the bar. He studied art in Paris and later in the United States, and in 1906 was made a member of the National Academy. His fame rests, however, on his *History of American Painting* (1905), which is notable for its sympathetic and just appreciation.

ISHII, ě'shĕ-ě, Viscount Kikujiro, Japanese diplomat: b. Chiba, Japan, 1866; d. Tokyo, May 25, 1945. Soon after taking a law degree at the University of Tokyo in 1890 he joined the staff of the Japanese legation in Paris, and from 1896 to 1900 he was consul in Chemulpo, Korea. In the latter year he was secretary of the legation in Peking (Peiping), during the siege by the Boxers (q.v.). He negotiated with the United States government in 1907 the agreement restricting emigration of Japanese to the United States, and the same year investigated the anti-Japanese riots in British Columbia. From 1912 to 1915 he was ambassador to France, then becoming minister of foreign affairs; in 1916 he received his viscountcy. In 1917 he went to Washington, D.C., as special envoy, there negotiating the Lansing-Ishii agreement with Robert Lansing, secretary of state, which recognized that Japan had special interests in China. Besides being versed in French, he was a fluent speaker

and writer in English. From 1920 to 1927 he again served as Japanese ambassador in Paris. During this period he took an active part in the work of the League of Nations, becoming president of its council in 1923 and once more in 1926. He retired from public life in 1927. His death occurred in an air raid by United States planes during World War II.

ISHIM, i-shim', Soviet Union. (1) Town of the Omsk Region, Russian Soviet Federated Socialist Republic, on the river of the same name, 180 miles northwest of Omsk. Founded in 1630, it is an agricultural center. Pop. 18,153. (2) River, rising in the north central area of the Kazak SSR and flowing northwest and north to join the Irtysh after a course of 1,330 miles.

ISHMAEL, ish'mā-ēl, from Hebrew, signifying "God hears," was eldest son of Abraham and Hagar, his handmaid (Genesis 16:15, 16). Of him it was foretold (Genesis 17:18, 20) that he would beget 12 princes and become a great nation—a promise repeated (Genesis 21: 18) to his mother when, driven from home by Sarah's attitude, both she and the lad were wandering in the territory south of Beersheba and death by thirst was near. Later he became an archer, dwelling in the wilderness of Paran, where Hagar "took him a wife out of the land of Egypt" (Genesis 21:21). In a later chapter (Genesis 25:9-18) it is stated that he died at the age of 137, having had, like Jacob, 12 sons, progenitors of 12 tribes that dwelt from "Havilah unto Shur, that is before Egypt, as thou goest to Assyria." Apart from the Biblical record few of the names have historical associations. Among various identifications more or less plausible may be mentioned Nebaioth with the Nabataeans, Yetur with Ituraea, whose archers were early Roman mercenaries; Kedar with the Kidru of the Assyrian inscriptions.

In the Midrash, the rabbis show how Sarah's disposition to Hagar was at first kindly but that Hagar's actions compelled a change. Ishmael's intercourse with Isaac is told with considerable minuteness at times, as when he invites his five year old brother to a contest with the bow and arrow and aims at the child in his duplicity. When Ishmael was at the point of death, God heard his prayer and caused a well to bubble forth that later was to refresh the Israelites on their journey through the wilderness. In Arabic lore Ishmael is no less a picturesque figure, and the Koran adds to his importance for it calls him a prophet (Koran 19:55). His son Kedar is reported to have been an ancestor of Mohammed. It is characteristic of Mohammedan tradition that Ishmael should be offered as a sacrifice instead of Isaac. We cannot tell historically how far the descendants of Ishmael entered Arabia and settled there, with its mixed population of thousands of years. Possibly the Bedouins in the deserts between Sinai Peninsula and the Persian Gulf are more entitled to claims of Ishmaelitic origin with their primitive and patriarchal form of life and ancient traditions.

ISHMAELITES. See **ISHMAEL**.

ISHPEMING, ish'pē-mīng, city, Michigan, in Marquette County, 14 miles west of Marquette, served by the Duluth, South Shore, and Atlantic, the Lake Superior and Ishpeming, and

the Chicago and Northwestern railroads. Machinery is manufactured for use in the neighboring great iron ore region. Settled about 1856, it received its first charter in 1857. The government is by city manager and council. Pop. 8,857.

ISHTAR. See **BABYLONIA**.

ISIDORE OF SEVILLE, iz'ī-dōr sē-vīl' (Lat. ISIDORUS HISPALENSIS), Spanish prelate and scholar; b. 560?; d. April 4, 636. In 600 he was appointed archbishop of Seville. A leading churchman of his day, he exerted a great influence upon the thought and literature of the whole Middle Ages. His *Originum seu Etymologiarum Libri XX* (known in English as *Etymologies*) was a great encyclopedic work. Consult Brihaut, E., *An Encyclopedist of the Dark Ages* (New York 1912).

ISINGLASS, i'zīng-glās, a form of gelatin (q.v.), whitish, firm in texture, and of great purity, prepared mainly from the sounds, or air bladders, of various species of fish, especially of the Russian sturgeon and, in the United States, of cod, sturgeon, and hake. In some cases the skins are also used for this purpose. Besides Russia, from which it had been principally obtained, the United States and Canada, Brazil, and the East Indies furnish considerable quantities. It is the basis of Russian glue, preferred to all other kinds for strength. It is used in making court plaster, cement, mock pearls, and many other articles; in clarifying fermented liquors for improving soups and jellies; and as sizing for linens, silk, gauzes, and other fabrics.

ISIS, i'sis, the principal goddess of the Egyptians, the sister and wife of Osiris (q.v.), representing the moon, as Osiris did the sun. The Egyptians believed that Isis first taught them agriculture. She is represented in various forms. In one she has the form of a woman, with the horns of a cow, as the cow was sacred to her. She is also known by the attributes of the lotus on her head, and the sistrum in her hand, a musical instrument which the Egyptians used in the worship of the gods. She is often accompanied by her infant son Horus. In one celebrated Egyptian statue she was shown with her face veiled. It was she who, by wiles, learned the name of the great Ra (Re) which no one else knew. She is also represented in legends as mourning for Osiris with her sister Nephthys. Herodotus identifies her with the Greek Demeter. The same author states that the worship of Isis and Osiris was the only common ritual throughout Egypt. She was particularly worshipped in Memphis, but at a later period throughout all Egypt. From Egypt her worship passed over to Greece and Rome, in about the 3d century B.C.

ISIS AND SERAPIS, Temple of, a structure of ancient Rome, situated in the Campus Martius. It was erected from Egyptian materials and in Egyptian style, and the approach was lined with many monuments brought over from Egypt. Of these there remain in Rome three obelisks, and the Nile statuary group, the latter in the Vatican Museum. The Tiber statue has reposé in the Louvre since 1803. Various smaller pieces have been recovered.

ISKENDERUN, is-kên-dêr-ôôn', Turkey, seaport of the vilayet of Antakiya, in a gulf of the same name at the northeast extremity of the Mediterranean; formerly it was known as ALEXANDRETTE or ALEXANDRETTA. Much of the seaborne trade of northern Syria passes through the port, which has rail connection with the main Turkish system. Alexandrette formed part of the Ottoman Empire down to the close of World War I, when it was occupied by French troops. In 1920 the seaport was incorporated in the French mandate of Syria, and the sanjak (district) of which Alexandrette was the capital was granted considerable autonomy in 1937; in 1938 the name of the sanjak was changed to Hatay, and in 1939 Hatay was transferred to Turkish sovereignty. Hatay became part of the vilayet of Antakiya (Antioch), and Alexandrette resumed its earlier Turkish name of Isken-durun. Pop. (1940) 13,997.

ISLA, ês'lâ, José Francisco de, Spanish Jesuit preacher and satirist: b. Vidanes, province of León, April 24, 1703; d. Bolonia, Nov. 2, 1781. He entered the Jesuit order at the age of 16, and became a teacher of theology and philosophy in various Jesuit colleges. Best known of his writings was the picturesque novel entitled *Historia del Famoso Predicador Fray Gerundio de Campazas, alias Zotes* (1758), a witty satire on the extravagances of the preachers of his day. The ridicule cut so deep that it was never forgiven by some of his fellow preachers; and they raised up for him powerful enemies who, in 1760, succeeded in having the sale of *Fray Gerundio* prohibited. Among his most popular translations was *The Adventures of Gil Blas de Santillana*, the French work by Alain René Lesage (q.v.). Other works of Isla included *Triunfo del Amor y de la lealtad: Dia Grande de Navarra*, which satirized the accession ceremonies of Ferdinand VI; and the satire *Cartas de Juan de la Encina*. His *Sermones Morales*, published posthumously in 1792-1793, testifies to his excellence as a preacher.

ISLA DE PINOS. See ISLE OF PINES.

ISLAM is a system of belief and practice established by Mohammed (q.v.), the Arabian prophet. To the Westerners it is better known under the name Mohammedanism, to which its professors prefer the other term. They themselves would also rather be called Moslems than Mohammedans. Mohammed died in 632 A.D. in Medina. Today there are some 300 million followers of his, forming the bulk of the population of Northern Africa and Western Asia, and extending all the way through India into Malaya, the East Indies, and the Philippines. Every seventh man living today is a Moslem.

Religion of Surrender.—The word Islam (*islām*) means surrender, submission (to the will of God). It occurs several times in the Koran (q.v.) in its literal as well as technical meanings. The form is an infinitival noun from a stem used in the Koran in connection with the submission of Abraham and his son, at the attempted sacrifice by the father, to the Divine will (37:103). It is presumably this act that first prompted Mohammed to coin the new designation for his religion. "This day have I perfected your religion for you and completed My

grace unto you; I have chosen for you as religion *al-Islām*" (5:5). "Verily the religion with God is *al-Islām*" (3:18).

Pervades all Domains of Life.—In the Western mind a clear distinction is normally drawn between two spheres of life: The spiritual, comprising religion; and the secular, comprising political, economic, social, and cultural activities. That is not the case with the Moslem. To him Islam embraces all departments of life, a kind of totalitarian system with control over all the varied domains of human activity. This is a unique feature of the Islamic religion. What Mohammed founded was not a religion only, but a society in which the religious, the political, and the social are inseparable.

Islam differs from Christianity in another important aspect. It has no ordained priesthood, no clerical hierarchy, and no mystic sacraments. It is a lay religion, a practical one, with no complicated theology and no unattainable ideals. As such, it has special appeal to the societies that are still on a low cultural level and makes progress where Christianity fails.

Viewed from our standpoint, the structure of Islam may be analyzed under three main headings: Religious, social, and political. The religious structure is composed of dogmas of belief and acts of worship.

Five Dogmas.—The first and most important article of Islamic faith relates to the oneness of God. It is expressed in the formula: *La ilāha illa-l-Lāh* (47:21), no god but Allah. This is one of the most often repeated formulas in the Arabic language. Its concept lies at the very foundation of the entire structure. Moslems pride themselves on being the only *muwahhidūn*, unitarians. God is one, He is pre-existent, omnipotent, omniscient. He is the creator of all things. "He is God, the one; God the eternal. He begets not and is not begotten; nor is there like unto Him any one" (112).

In the Koran He is again and again described as "powerful over all things," "knowing all things." But He is also gracious, forgiving, merciful, and compassionate. As the ruler of all things He may do whatever seemeth good in His sight; yet He is a just God. He punishes only where punishment is due. Humble submission to His will has throughout the ages constituted the essence of Islamic piety.

Closely joined with this dogma is the second one, expressed in the formula *Muhammadsun rasūlu-l-Lāh*, Mohammed is the messenger of God. The two are usually repeated together. Mohammed, according to the learned system, was not divine. He was a messenger, a warner, and a prophet. As a prophet he was in the tradition of Noah, Abraham, Moses, and Christ. But he was "the seal of the prophets" (33:40), the last and therefore the greatest among them. He was the sole channel of revelation for his own time and generation, and the last apostle for all times and all generations. His dispensation supplements and, wherever necessary, supersedes all earlier ones. He performed no miracles unless it be that of the Koran. He was the means through which the Koran was revealed.

The third article of faith relates to the Koran. This book is the uncreated word of God. It was dictated piece by piece in Arabic through Gabriel. As such, it should be studied and recited in the original tongue. Only the Turks have recently violated this rule. When

quoted, a koranic passage is introduced with "saith God." In its Arabic form, it is an exact replica of a divine book preserved in the seventh heaven, where it is well guarded. None therefore should touch it unless in a state of purity, which involves ablution (56:76-8; 80:13-15).

Then comes the belief in the angels, arranged in a hierarchy and headed by Gabriel, bearer of the revelation (2:91). Angels were created long before the world and are of finer material. They perform different functions. They intercede for man (42:3), act as guardians (13:12), and support the throne of God (69:17). The names of many of them, as recorded in the Koran and Moslem tradition, are of undoubted Hebrew origin.

Hell and Heaven.—The last fundamental article of faith is belief in a judgment day, immortality of the soul, reward for the righteous, and punishment for the wicked. "The last day," "the last hour," "the day of judgment" will be ushered in by certain extraordinary signs. On it, all actions shall be weighed in the scales. "Those whose scales are heavy are the successful ones; and those whose scales are light shall lose their souls and abide in hell forever" (23:104-5). The sin for which one is punished may be moral or ceremonial. One sin is unpardonable, that of *shirk*, associating other deities with the one God (4:51, 116). Later theologians distinguished between "little" sins, which are inherent in man's nature, and "great" sins, for which a Moslem, if he does not repent, will be consigned to hell-fire. Immediate expectation of a day of judgment and fear as a motive of piety were stressed before the time of Mohammed by Syrian Church fathers.

To Mohammed, as revealed in the Koran, the last day was not a hazy possibility in a remote future but an imminent certainty. On it, all the dead shall rise. Resurrection entails the body. Both reward and punishment are of the sensual type. Hell is portrayed as God's kindled fire, which shall verily rise above the wicked like a vault on outstretched columns (104:5-9). There the damned shall be "scorched by burning fire, made to drink from a boiling fountain. No food shall they have save the fruit of a bitter thorn, which doth not nourish nor appease their hunger" (88:4-7). Such passages provided material for the fertile imagination of Moslem commentators, who worked out elaborate and fantastic schemes of torment. They arranged hell in seven divisions, and consigned different evil doers into different divisions varying in the degree of torture.

Paradise is also painted in materialistic colors. In it the faithful is to enjoy all the delights and luxuries nearest to the heart of a denizen of the desert. The general picture is that of an oasis, a garden, with shady trees, running streams, and all facilities for rest, comfort, and enjoyment. Several passages in the Koran dilate on the scene: "He [God] hath awarded them [the believers], for all that they endured, with Paradise and silk attire, reclining therein upon couches. Naught shall they know of [hot] sun or bitter cold. Its shades shall close upon them, and low shall its fruits hang down. Vessels of silver are brought round for them, and goblets like flagons, flagons made of silver whose measure they themselves shall mete. There they are given to drink of a cup whereof the mixture is of ginger from the fount named *salsbil*. There

go round among them boys of everlasting youth whom, when thou seest, thou wouldst take for scattered pearls. And when thou lookest at this, thou wilt see bliss and high estate. Their raiment will be fine green silk and gold brocade. With silver bracelets they will be adorned, and their Lord will give them drink of a pure beverage" (76:12-12).

Belief in God's absolute decree is often treated as a sixth article of faith. The Koran is explicit in its teaching that everything that happens to man has already been fixed by God: "Naught befalleth us save that which God hath decreed for us" (9:51); "No soul can ever die except by Allah's leave, in accordance with what is written and determined" (3:139).

Five Religious Duties.—Islam is not only a system of faith but one of practice. It enjoins on its followers five acts of worship, religious duties, often termed the pillars of faith.

The first pillar involves a verbal profession of the unity of God and the prophethood of Mohammed. It is not enough for a Moslem to believe in God; he must declare his belief: No God but Allah; Mohammed is the messenger of Allah. This formula is of such importance that once a non-Moslem recites it, he is to all intents and purposes a believer. In order to be a good believer he should then proceed to the practice of the other acts.

The second act of worship is prayer. A good Moslem could informally commune with God any time of day or night, but he is obligated to practice five legally prescribed and defined prayers. This formal prayer is made with the utmost decorum. Preparatory to it the worshiper should go through certain ceremonies of purification and ablution (5:8-9). Every mosque is provided with facilities for such washings. Sand or dust would do in the absence of water. After going through the required ablutions the worshiper stands straight with his face toward Mecca, assumes a fixed position, recites certain formulas, and repeats a number of genuflections. The five times are early dawn, noon, mid-afternoon, sunset, and night. It is remarkable that in no single Koranic passage are the five periods mentioned. Even when added, the periods seem to be four. But all commentators agree that the *masā'* period includes two: sunset and evening (30:16-17).

The approach of each hour of prayer is heralded by the call to prayer, made by the muezzin (q.v.) from the minarets:

God is most great! (repeated four times)
I testify there is no god but Allah; (twice)
I testify Mohammed is the messenger of Allah. (twice)
Come to prayer; (twice)
Come to salvation. (twice)
God is most great! (twice)
There is no god but Allah.

Assuming a fixed posture while engaged in formal prayer, as well as bending the knees and prostrating oneself, were a well-known practice among monks and hermits of the Syrian Christian Church. An early Arabic poem refers to a monk's forehead as hard as a camel's knee on account of religious prostrations. Islam, however, regularized and popularized the practice. An orthodox Moslem is, as a rule, not ashamed of his God. He may be seen indulging in this devotional exercise in the bazaar, the field, or the modern street car.

Friday noon is the only prescribed congregational prayer. In it the members meet in

mosques, devoid of pews and unornamented with pictures, arrange themselves in standing rows, and follow the leader (*imām*) in the conduct of the service. The leader delivers a sermon (*khutbah*) in which he invokes God's blessing for the success of Islam and the prosperity of the rulers and the caliph (in cases where there is one).

Almsgiving, the third duty of the believer, is often joined with prayer in the koranic injunctions. "Observe prayer, pay the alms, and kneel with those who kneel" (2:40; cf. 2:77, 9:5). In the early days of Islam alms were collected from believers by officials appointed for that purpose, and were used for building mosques, helping the needy, and in other ways promoting the cause of the religion. With the spread of Islam this procedure was necessarily abandoned; giving became a personal affair. The obligation to give is nevertheless universally recognized by Moslems. Even those among them who neglect other duties may not neglect this.

Fasting is the fourth religious duty prescribed by Islam. The month of Ramadan is devoted for this purpose. In it the faithful are supposed to abstain from food, drink, and other indulgences from dawn till sunset (2:183). Ramadan was chosen because it was the month in which the Koran was revealed. Being a lunar month it rotates around the year, and fasting in it becomes arduous when it falls in summer. Exemptions are made in favor of the feeble, the sick, and the traveler (2:181). To fast at other times is meritorious but not obligatory.

Both Christians and Jews practiced fasting before Islam. Besides regularizing and emphasizing it, Islam put a somewhat different interpretation on it. The object of Moslem fasting is not so much to mortify the body as to atone for evil deeds and to commune more intimately with God.

Pilgrimage.—The fifth requirement of practical religion is the pilgrimage to the holy places in Arabia. Once in a lifetime the Moslem, whether man or woman, is supposed to undertake the religious pilgrimage at a stated period: "It is a duty toward God, incumbent on those who are able, to visit this House" (3:91). Women with no male relatives to accompany them, lunatics, and those who cannot afford the trip are exempted. The time is fixed in the first half of the month of *dhu-al-Hijjah*. In that period the caravans from Syria, Egypt, Iraq, and other parts of the Moslem world converge on Mecca. In 1946 the estimated number of pilgrims was 50,000. Before World War II it rose as high as 250,000.

That pilgrimage to sanctuaries is an ancient Semitic rite is indicated by its prescription as an indispensable duty in the old part of the Pentateuch (Ex. 23:14). But, as in the case of other institutions borrowed by Islam, it was modified and crystallized. When the pilgrim approaches the sacred area around Mecca, he goes through the ablutions, puts on a special seamless garment, and proceeds with the other pilgrims. Guides instruct him as to the proper procedure. While in this state he cannot even trim his nails or kill a flea. First he must encircle the Kaaba (q.v.) seven times, kissing the Black Stone each time. This is a meteoric stone set in the southeast corner of the Kaaba and, like it, a relic of pre-Islamic heathenism. Moslem tradition says that it came down from Paradise, and that on

the judgment day it will give evidence in favor of those who kissed it. Other prayers and ceremonies follow. Then the pilgrim must run seven times between two hills, al-Safa and al-Marwah, repeating certain formulas (2:153). Later he visits the Valley of Mina and Mount Arafat, where more prayers are recited and a sermon is preached. On the way to Mina each pilgrim casts stones at three pillars, seven stones at each. The stones are, according to Moslem explanation, really thrown at Satan, who appeared on this spot to Abraham. A sacrifice of a sheep or goat closes the performance. The rich may sacrifice a camel. It is considered meritorious to give the meat of the sacrificed animal to the poor. The day is celebrated throughout the world of Islam as 'Id al-Aḍḥa (the feast of sacrifice).

The pilgrim at last shaves, discards the special cloak, and reverts to the secular condition. While in Mecca he usually drinks from the water of Zamzam, the sacred well within the precincts of the mosque, supposed to be the one from which Hagar and Ishmael drank when lost in the wilderness. Before returning home the pilgrim should do homage at the tomb of Mohammed at Medina. He is entitled to the proud designation of *hājj* (pilgrim) before his name.

Holy War.—The obligation of waging holy war (*jihād*) has been raised to the dignity of a sixth pillar of faith by one of the Islamic sects. Moslem ideology divides the world into two zones: the abode of Islam, where peace prevails, and the abode of war, which includes all the non-Moslem domain. It is further considered obligatory on the Moslem to keep on pushing the wall that separates these two zones until all lands are brought under the banner of Islam. The ordinary greeting between one Moslem and another, no matter what their languages may be, is the Arabic *as-salāmu 'alaykum*, peace be to you!

The koranic passages in support of the holy war theory are not so explicit. This is one of the most elaborate among them: "Fight in the path of God against those who fight against you, but be not the aggressors; for verily God loveth not the aggressors. And slay them wherever ye find them, and drive them out of the places whence they drove you out, for persecution is worse than slaughter. But if they desist, then verily God is forgiving, merciful" (2:186-8).

Social Structure.—From analysis of the religious structure, we now proceed to that of the social structure of Islam.

Foremost in the koranic legislation on the social side is the consideration of all those within the fold of Islam as one brotherhood. "The believers are naught else but brothers" (49:10). The earliest biographer of Mohammed quotes from a sermon which the Prophet delivered at the last pilgrimage he made: "Know ye that every Moslem is a brother unto every other Moslem, and that ye are now one brotherhood." Until then blood relationship was the cohesive binding element in Arabian society. Now this is replaced by a new cementing element—faith. In its historic evolution the Moslem community fell short of this ideal, but Pan-Islam is still, until the present day, a conscious force in the lives of Moslems. It transcends race, color, or nationality. Perhaps more than any other religion, Islam has succeeded in breaking down ethnic and provincial barriers.

Marital Laws.—Another important part of social legislation relates to marriage. Islamic marriage laws are quite liberal. "Marry of the women who seem good to you, two, or three, or four; and if ye fear that ye cannot be equitable, then only one, or what your right hands possess" (4:3). The last clause authorizes using female slaves as concubines. In this legislation Islam restricted polygamy rather than introduced it; but while restricting it, it put the religious label on it and froze it forever after. The modernized Moslem society has outgrown this legislation in favor of monogamy.

The believer is commanded to practice restraint and chastity and to treat his wives with kindness. Women are enjoined to be decent, to lower modestly their glances, and to display their charms only to their husbands and immediate relatives. This hardly involves the duty of veiling or confinement in a harem, both ancient Semitic institutions antedating Islam.

The statutes relating to divorce (2:226-38, 4:24) enable a husband to repudiate his wife without any misbehavior on her part, even without assigning a cause. Divorce is effective if expressed by one who is sound in mind and mature of age. But there are conditions to be fulfilled. The husband should wait for a prescribed time, to be sure that the wife is not pregnant, and should pay the fixed dowry. The period of waiting may be intended not only to remove all doubt about the real parenthood of a child, but to give the man an opportunity to change his mind in case of a hasty decision. The repeated admonitions to observe the divorce regulations indicate that the details were not previously known. Islam gives the wife the right of dissolving the marriage bond under certain conditions, a right she never enjoyed before.

The morality proclaimed by Mohammed is largely of social character. The koranic legislation in favor of the poor, the orphan, the sick, the stranger, and the destitute is copious and adequate. Here is a sample passage: "Unto your parents show kindness, and unto kindred and orphans and the needy, and unto the neighbor who is a kin and the neighbor who is a stranger, and unto the fellow traveler and the wayfarer, and whom your right hands possess" (4:40). The Prophet evidently never forgot that he himself was once an orphan, and was poor. Almsgiving, as noted above, was raised by Islam to a position of pre-eminence, along with prayer and fasting.

Slavery is authorized by Islam, as is evident from the last phrase in the passage quoted above, but humane treatment is enjoined throughout. Mohammed found slavery as an established institution in pre-Islamic heathenism, as well as in the Jewish communities, and recognized its legitimacy. Moslem men, as noted above, were authorized to use their female slaves as concubines. If one gave birth to a child, she usually became a freedwoman. Whenever a slave was in a position to redeem himself it was the duty of the Moslem master to grant emancipation (24:33). More than that, manumission has been treated throughout the Islamic age as something especially pleasing in the sight of God and regarded as an expiation for sin. Moslem history is rich in cases where masters sought God's favor through freeing slaves, sometimes going first through the trouble of purchasing them for the sake of enfranchising them. According to the strict law, no Moslem

could enslave a fellow Moslem. If a slave adopts Islam, freeing him is meritorious but not obligatory.

Prohibition.—Other interesting parts of koranic legislation relate to drinking wine and to gambling. In one passage, the prohibition is explicit and absolute: "O ye who have believed, wine, games of chance, idols, and divining arrows are nothing but an infamy of Satan's handiwork. Avoid them so that ye may succeed" (5:92). In another passage, the prohibition is not so final: "They question thee concerning wine and games of chance. Answer: In both there is great sin, and also some utility for men; but their sinfulness is greater than their usefulness" (2:216).

Other Islamic prohibitions relate to food. Especially interesting among these is one involving pork (5:4), which should under no conditions be eaten. Any flesh that is eaten must come from an animal killed in a prescribed way.

Non-Koranic Sources.—For a full comprehension of Islamic religion in its varied aspects, and particularly in its social and political ones, a study should be made not only of the Koran but also of the practice and sayings of Mohammed as portrayed in the *Sunnah*. Basically, the term means "path," "way." First applied to the way Mohammed taught by word or deed, *Sunnah* was then stretched to include the way his immediate followers acted, and later to the way of life pursued by the Moslem community at large.

The *Sunnah* is recorded in books entitled *hadith*, "communication," "narrative," "tradition." There are six authoritative collections of Moslem tradition. They constitute, next to the Koran, the most important source of Moslem religion, law, and practice. Then there is the established custom which conditioned the social and political development of Islam as it spread, and which contributed new elements to its social and political structure.

Certain universally accepted practices have no sanction in the Koran. The doctrine of the sinlessness of the prophets, including Mohammed, is not koranic but nevertheless is orthodox, as is the doctrine of his intercession on the day of judgment to the exclusion of all other prophets. The cult of the dead and the veneration of saints are contrary to the spirit of Islam, with its insistence on strict monotheism, but are practiced today all over Islam with the exception of its Wahhabi section. Circumcision is not even mentioned in the Koran, and yet it has been considered throughout all Moslem generations as the chief initiatory rite for converts, corresponding to Christian baptism. The custom is a very ancient one, and was practiced by Hebrews, Aramaeans, and other Semites.

Political Structure.—For our knowledge of the political structure of Islam we have to depend almost entirely upon non-koranic sources. The nearest approach in the Koran to what might be termed civic or state legislation is a general behest to the believers: "Obey God and obey the messenger and those of you who are in authority; and if ye have a dispute concerning any matter, refer to God and the messenger, if ye believe in God and the last day" (4:62). It was this command to obey "the messenger" that later sanctioned the use of the *Sunnah* as the second major source of authority in Islam.

Caliphate.—The most important political institution is the caliphate, succession to Mohammed. On this the Koran is silent. For successor, Mohammed could have one who performed his functions only as a leader, ruler, judge, and commander in chief of the army, but not as a prophet; he, being the last of the prophets, could have no successor as such. As long as Mohammed lived, Islam was a theocracy, "a community of God," a state under the direct government of Allah through His Prophet. With his death, revelation forever ceased. In his prophetic function Mohammed, therefore, could have no substitute. Only the Fatimid caliphs of Egypt (909-1171), who were extreme Shi'ites, were considered by their followers as semidivine rulers of a theocratic state.

The unexpected death of Mohammed in 632 left the community in a state of confusion bordering on consternation. At his death, he had no living son. Even if he had, it would not have made much difference probably, as Arabian practice did not justify hereditary succession into positions of leadership, unless the son was the best qualified candidate. Nor did Mohammed designate a successor. The Shi'ites, however, maintain that he did, and that the designee was his son-in-law, Ali. But when the elders got together they elected the aged abu-Bakr, a kinsman and early believer, caliph. Abu-Bakr started the first series of caliphates, which was patriarchal in character, and used Medina as capital. In 661 the capital was shifted to Damascus and a new series, the Omniad (Umayyad), was inaugurated. In 750 the Abbasid caliphate superseded the Omniad; shortly after that, Baghdad replaced Damascus as the capital.

Caliphal Qualifications.—Moslem legists stipulate that the caliph should be a male, descended from Koreish, sound in body and mind, mature in age, learned in law and religion, and capable of defending Islam. In practice, however, little regard was paid to these stipulations. The last caliphate was that of the Ottoman Turks, who were not even Semites. This caliphate was abolished by the Kemalists in 1924. Since then, several Pan-Islamic conferences have been held to revive this institution, but to no avail. Among the caliphal privileges is that of declaring a holy war, a privilege which was exercised by one of the last Ottoman sultans, Mohammed V, when Turkey entered World War I in 1914, but resulted in no action whatsoever.

Criminal Legislation.—The criminal legislation of the Koran, which is meager, follows ancient Semitic lines. It was revealed as different occasions arose, and constituted no organized comprehensive system. "We have prescribed for thee therein: A life for a life, an eye for an eye, a nose for a nose, an ear for an ear, and a tooth for a tooth, and for wounds, retaliation. But whoso forgoeth it, it shall be expiation for him" (5:49). "As for the thief, both male and female, cut off their hands. It is the reward of their own deeds, an exemplary punishment from God" (5:42). Only in Wahhabi Arabia is this stern legislation enforced. Moslem communities everywhere have adopted more liberal laws based on European practice. This is especially true of the modern Turks.

Local Institutions Adopted.—The tiny Medinese community of Mohammed's days ex-

panded until it encompassed first the entire Arabian peninsula, then the Fertile Crescent to the north, and later adjacent lands in North Africa, Southeastern Europe, Western Asia, and Central Asia. It soon became apparent that the laws worked out for it did not suffice to meet the multitudinous and varied problems, political and economic, which confronted the far-flung caliphal state and its component parts. To supply the deficiency it was only natural for the new Moslem state to adopt much of the governmental organization of the conquered lands, together with the necessary local laws and methods of procedure.

When the seat of the caliphate was transferred to Syria, the ruling Moslems retained the native Christian staff, remnant of the Byzantine system, who continued for some time to keep their records in Greek. The provincial system of administration and taxation, somewhat modified, was continued. When a new caliphate arose in Iraq, the Persian system of rule through vizirs and provincial governors was appropriated. The Ottoman caliphs inherited Byzantine institutions, and followed Byzantine political patterns. What in the long run determined the governmental theories and administrative structures of the many successive and contemporaneous Moslem governments in Asia, Africa, and Europe was not so much the Koran and the Sunnah as the fresh heritage and the force of events in the new locales.

New Devices.—Meantime Moslem legists were exercising their ingenuity to provide new devices for meeting the new situations. In all the conquered territories Arab governors found themselves confronted with problems which had no exact counterparts in the limited Arabian experiences. The administrators in some such cases had to resort to their personal judgment and sense of equity (*ra'y*). This, then, became a secondary source of legislation. Under other circumstances it was found that for certain new cases parallels could be discovered in early Islamic experience, and judged accordingly. Reasoning by analogy (*qiyās*), analogy to a decision recorded in the Koran or tradition, thus became another new source of authority. Gradually a third doctrine was worked out, that of the consensus of opinion (*ijmā'*). According to this doctrine, all such practices or articles of belief as are general among Moslems are an acceptable part of religion. To bolster the theory behind this doctrine, Mohammed was quoted as having said: "My community shall not agree on an error."

Four Rites.—On the basis of these sources, four permanent schools of jurisprudence arose in Islam. The earliest and most liberal among them was that established by abu-Hanifah, who flourished in Iraq, where he died in 767. The school named after him, Hanafite, which emphasizes the principle of analogical deduction, today predominates in Turkey, Western and Central Asia, and India. A contemporary of abu-Hanifah, Malik ibn-Anas (d. 795), labored in Medina; he was naturally more conservative than his Iraqi colleague. Malik stressed the importance of the consensus of opinion as prevalent in Medina, and his school struck root in North Africa and Spain. The third school of jurisprudence, the Shafi'ite, occupies a medial position between the liberal Hanafite rite and the conservative Malikite. It still dominates

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Lower Egypt, eastern Africa, Palestine and the East Indies. Al-Shafi'i, its founder, was born in Palestine but spent most of his life in Baghdad and Cairo, where he died in 820. His pupil, ibn-Hanbal of Baghdad (d. 855), insisted on uncompromising adherence to the Koran and tradition, and became the founder of the fourth and most conservative of the rites. The Hanbalite school declined after the 15th century but was revived by the Wahhabis, strict traditionalists, in the 18th. The ruling family of Saudi Arabia is Wahhabi.

All four schools are orthodox. The Shi'ites, however, utterly reject consensus of opinion as a source of legislation, and follow a rite of their own. They maintain the absolute authority and judgment of the infallible imam, successor of Ali. The Shi'ites, moreover, hold that their own spokesmen are qualified to interpret the ideas of their imams; the Sunnites, on the other hand, maintain that the "door of interpretation has been closed forever."

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ISLAMIC ART AND ARCHITECTURE, *is-lām'ik*. The Arabs, who in the 7th century A.D. embarked on the conquest of the huge area stretching from Spain to India, brought very few, if any, important artistic or architectural ideas with them. It is in the earlier arts of Rome, Byzantium, Iran, and, more remotely, India, that one must look for most of the formal and technical sources of Islamic art and architecture. But the faith of Islam which created the major bond of unity between the very diverse peoples of the Muslim world did carry with it certain physical requirements and ideological precepts which affected the arts. Of these, three may be mentioned as of particular significance.

First, the practice of Islam required in every center of importance at least one place of worship (Arabic *masjid*, whence "mosque"), which was also—especially in early times—the main social and political center of the city. The typical mosque had to be large in order to hold most of the population of a city; in addition, within the first century after the appearance of Islam, the mosque acquired certain elements which were to become standard in all Muslim countries, even though their specific shape varied: the *mihrab*, or niche, on the back wall of the mosque, which originally symbolized the place from which Mohammed led prayers, and later came to indicate the position of Mecca toward which prayer is directed; the *mimbar* (*minbar*), a chair for the preacher and leader of prayers; one or several



Marie J. Mattson from Black Star

Court and sanctuary of the Umayyad or Great Mosque, Damascus, Syria, built in the early 8th century.

minarets, towers from which the faithful are called to prayer; and a place for the ritual ablutions which precede prayers.

Second, one of the main tenets of Islam was its absolute monotheism, and in particular its conception of God as the only Creator. Since representations of living beings in ancient and medieval times often had the magic significance of equating or even replacing reality, Muslim theologians (and not, as is often thought, the Koran) maintained that representations of living beings were infringements on divine prerogatives. In fact it was only in religious art that this opposition to representations made itself felt;

Mosque of Omar (Dome of the Rock), city of Jerusalem, built by the Umayyad caliph Abd-al-Malik (r. 685-705).

George Palmer from Black Star



its main consequence was the development of a secular art at the expense of a religious one.

Third, the central source of the Muslim faith is the Koran, the sum of the revelations given by God to His Prophet. The holiness of the Koran and the divine nature of its message led the Muslim world to impart holiness to any written text, and as a result calligraphy became the most original and most complex artistic form in the Muslim world, even though the least accessible to untrained eyes.

MAJOR PERIODS OF ISLAMIC ART

Umayyad Period (661-750).—The Umayyad period was the formative one for Islamic art (see Umayyads). The center of the Umayyad Empire was in Syria and Palestine, where most of the monuments which remain from this time are found. The Great or Umayyad Mosque (begun in 705) in Damascus and the Dome of the Rock (691) in Jerusalem are the two major Umayyad religious buildings. In construction (the use of arches on columns and piers, and of domes) and decoration (mosaics) they follow the methods and uses of the earlier Christian civilization, but the plan and size of the Great Mosque of Damascus (a rectangular area 516 by 328 feet consisting of a courtyard surrounded by a portico on three sides and a three-aisled sanctuary on the side facing Mecca) and the purpose of the Dome of the Rock (to establish a Muslim holy place in the holy city of Christians and Jews, later considered as the place from which Mohammed ascended into heaven) show consideration for the physical requirements of the new civilization. In addition to these two edifices, there remain from this period a large number of princely residences, mostly scattered in the Syrian Desert: Mshatta (al-Mushatta), Khirbat al-Mafjar, Qasr al-Hayr, and Qusayr 'Amrah. These were decorated with frescoes representing the lives of the princes and with stucco sculptures, both representational and decorative. The style and the

iconography of these paintings show considerable influences from the Iranian East mixed with those of Byzantine art, reflecting thereby the whole extent of the newly conquered empire. In addition, architectural decoration (especially of the well-known Mshatta façade) exemplifies new techniques in ornament—the covering of the whole surface of the wall with intricate designs of flowers, leaves, fruits, and geometric motifs.

Period of the Caliphates (750-Mid-11th Century).—This period saw the formation of the great new Islamic metropolitan and cultural centers: Baghdad, founded in 762; Cairo, founded in 969; and Córdoba, an older city transformed by the Umayyads of Spain into the major urban center of Western Europe as early as the 8th century. Although the period is less fully documented by monuments than the preceding one, it is important both because of the individual styles which made their appearance then, and because it was remembered in later times as a particularly brilliant time. In architecture, the great ruined mosques of Samarra (on the Tigris, temporary capital of the Muslim world in the 9th century), the Azhar (972) and Hakim (990-c. 1013) mosques in Cairo, and especially the splendid mosque of Córdoba (begun in 786), show that Muslim architects had fully developed a new type of religious building. Using brick or stone, pillars or columns, long naves or square bays, flat roofs or vaults, they created large hypostyle halls which were preceded by porticoed courts. The orientation of the halls toward Mecca was often emphasized by a high central nave and by a dome in front of the mihrab. As a rule these mosques show a remarkable simplicity of design and construction, but in some cases, as in Córdoba, certain novelties appear. The arches are broken up into smaller units which in turn are arranged into patterns more decorative than structurally important, and similar effects are created in domes. This tendency to conceive of an architectural building as a decorative unit came to be characteristic of Islamic architecture and is further emphasized in Córdoba and elsewhere by the importance given to stucco and stone sculptures, decorative brick designs, and mosaic decorations on the most important parts of the buildings.

Since little has remained of secular building from this period, we do not know much about the architecture of the celebrated palaces which adorned Baghdad or Cairo; but objects in gold, silver, bronze, wood, silk, and ceramic, together with stucco fragments from Samarra, have given us a fair idea of the luxury which surrounded the princes who, like Harun al-Rashid, contributed to creating the *Thousand and One Nights* image we have of that period. The most important characteristic of many of these objects, and especially of the stuccoes from Iraq and the woods from Egypt, is the arabesque, a decorative design using geometric, vegetal, or purely abstract motifs so arranged that the design is always symmetrical, tends to cover the whole surface to be decorated, and can be continued indefinitely. In this type of ornament the central motif loses its individual meaning and becomes absorbed into a continuous surface design.

Among individual objects of this period the most remarkable ones are the bronzes of Fatimid Egypt; the ivories of Egypt, Spain, and Sicily; and the splendid series of ceramics from Egypt, Iraq, and eastern Persia. It was probably in Iraq that the greatest Islamic contribution to

The Moorish Great Mosque, Córdoba, Spain, begun in 786.

Illustration Research Service



ISLAMIC ART AND ARCHITECTURE

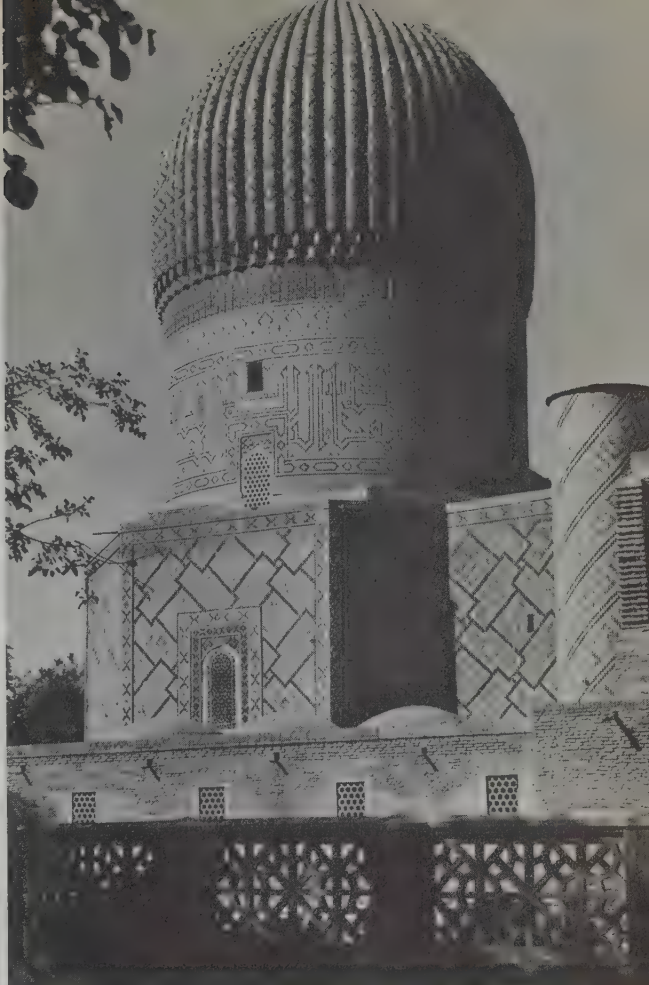


Above: Intricately patterned detail of arch over entrance to Masjid-i-Shah mosque in Isfahan, Iran.

Right: One of the architectural jewels of Samarkand, USSR, is the Gur-Amir mausoleum, begun by Timur in 1404.

Below: The Malwiyah, spiral prayer tower of Samarra, Iraq, dating from the 9th century.

(Top left and bottom right) Davis Pratt from Rapho Guillumette; (top right) Illustration Research Service; (bottom left) Iraq Petroleum Co. Inc.



Below: The Masjid-i-Shah, or Royal Mosque at Isfahan, Iran, built by Shah Abbas I early in the 17th century.





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Seljuk bowl with underglaze painting, Kashan, Iran.

the potter's art was invented, namely, luster—the covering of the object with a thin vitreous coat which gives it a brilliant and glowing effect after firing. The most novel designs, however, are found in eastern Persia. There, in the so-called Afrasiyab group, we see for the first time a very effective use of black or red inscriptions on a monochrome ground. There, also, in some of the types uncovered at Nishapur, we meet with more elaborate designs combining animal, human, and vegetal elements in a fantasy of strong colors and simplified shapes.

Seljuk Period (Mid-11th Century—Mid-13th Century).—In the 11th century the Seljuks, a dynasty of Ghuzz Turks, restored a semblance of order to a disintegrating caliphate (see SELJUKS). Seljuks ruled the caliphate more or less directly for about a century after having taken Baghdad in 1055, and their ideas influenced the whole of the Near East. Even in Egypt and the

West, where Seljuk rule was not fully accepted, we find artistic and intellectual developments closely related to the Seljuk developments proper. It was a period of great fermentation in the Islamic world: while the Turkish conquests of Anatolia and parts of India and the conversion to Islam of much of Central Asia widened the area of the Islamic world, the newly developed feudal structure gave power and wealth to dozens of centers which previously had been mere provincial towns. It was also during this period that Persia took over to a large extent the cultural leadership of the Muslim Near East and the great Persian lyrical and mystic poetry was developed.

In architecture two major novelties are to be noted. The first one is in the rapid development and spread of a Persian brick architecture. There appeared a new plan for mosques, exemplified in the Congregation Mosque or Masjid-i-Jami of Isfahan, which consisted of four monumental *iwān*'s opening on a central courtyard, with the direction of Mecca emphasized by a large dome at the rear of one of the *iwān*'s. (An *iwān* or *ivan* is a vaulted hall of pre-Islamic origin closed on three sides and entirely open to the outside on the fourth.) The monumental *iwān*'s are separated from each other by complex vaults on heavy pillars, with a façade made up of two tiers of arches which repeat on a reduced scale the generally keel-shaped pattern of the central *iwān*. The main emphasis of the builders was on the vaults and domes; and with the traditional inventiveness of Muslim builders for decorative designs, they developed splendid zones of transition between square and dome. The main feature of these transitional zones was the *muqarnas* (also called stalactite or honeycomb), consisting of sections of niches and vaults arranged in a three-dimensional symmetrical order. Also in the Seljuk period glazed tiles began to be used for the decoration of façades of mosques and certain parts of the interior.

The second architectural novelty of the Seljuk period is the reappearance and rapid expansion of mausoleums, often attached to pious foundations such as mosques, hospitals, and schools. The exact origins and historical significance of these mausoleums still await investigation, but with their characteristic domical shapes, large and heavily decorated or simple and unadorned, they have formed a characteristic feature of the Islamic landscape since the time of the Seljuks.

In metalwork and ceramics this was also a time of considerable change. Newly adopted or newly refined techniques (including silver inlay on bronze and better methods of fixing colors on ceramics) provided the Seljuk artist with excellent means to develop new artistic motifs. In metalwork, originally utilitarian objects such as candlesticks, kettles, trays, and boxes were adorned with images depicting incidents from the lives of princes and with complex arabesques of geometric and vegetal forms, and were thus transformed into splendid works of art in which great craftsmanship was combined with endless variations on a few established themes. In ceramics, the Seljuk period was the heyday of Persian potters. In centers such as Rayy and Kashan, complex compositions and at times brilliant colors were combined with iconographic themes derived from stories, lives of princes, and mystical poems, to create bowls, plates, and tiles in which the



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Luster painted bowl, early 12th century, Rayy, Iran.

ISLAMIC ART AND ARCHITECTURE

decorative spirit of Persian art found its full expression.

Also in this period we see the growth of illustrated manuscripts. The most characteristic among them were the illustrations of literary works, such as the amusing stories of al-Hariri's *Maqamat* (see HARIRI, AL-). Within certain stylized limitations, such as a tendency toward a two-dimensional vision of the image, these miniatures are splendid documents of the life of 12th and 13th century Arab towns; in an interesting opposition to most of the earlier and contemporary traditions, the miniaturists consciously attempted to copy scenes and activities which they themselves had witnessed.

LATER ISLAMIC ART

The Mongol conquest, culminating in the sack of Baghdad in 1258, profoundly changed the complexion of the Muslim world. There emerged four separate Muslim worlds whose relationship to each other decreased with time and whose arts, although occasionally still international in character, tended to develop separately.

Arab World.—From 1258 to 1517 the main power in the Arab world was Egypt under the dynasty of the Mamluks (see MAMELUKES). As rulers these former slaves covered the cities of Egypt and Syria (especially Cairo) with a splendid series of monuments, mostly religious foundations, which testified less to their piety than to their great wealth. Few new forms were created; the iwans of Persian origin, the traditional porticoed courts, and the domes of the previous period predominated, but in the quality of the workmanship, and in the splendor of the decorative effects in marble, stone, mosaics, glass, and stucco, the Mamluk monuments of Cairo are quite unique. These include the complex of Qalaun (Qalawun) (1284) and the mosques of Barquq (1386), Sultan Hasan (1362/1363), and Baybars (1269), to name but a few. In other techniques, especially metalwork, glasswork, and miniature painting, the results were not less effective, at least in technical virtuosity; but here again the liveliness and inventiveness of the preceding centuries made way for a somewhat dry perfection.

In the West, the Muslim kingdoms of North Africa and Spain were politically unstable, but in the Alhambra of Granada (constructed in the 13th and 14th centuries) they left one of the few remaining examples of a late Islamic palace. The Alhambra's luxurious gardens, fountains, and wealth of decoration, were a constant source of inspiration to the West, and its themes were often copied by Christian princes.

Persian World.—Of all the areas which suffered from the Mongol conquest, Persia revived soonest and, in the four centuries which followed the conquest, soared to the greatest heights. While its architecture—notably the Blue Mosque in Tabriz, completed in 1465; the Royal Mosque (Masjid-i-Shah) at Isfahan, completed in 1616; and the mausoleums built at Samarkand at the time of Tamerlane—was as splendid as ever, and while its decorative arts (especially carpet weaving) acquired at that time a fully justified renown, the greatest and most characteristic art of post-Mongol Persia was its miniature painting.

The origins of this Persian painting are to be found in earlier Islamic art, in China, and in Central Asia, but its spirit reflected the themes and motifs, as well as the ideals, of Per-

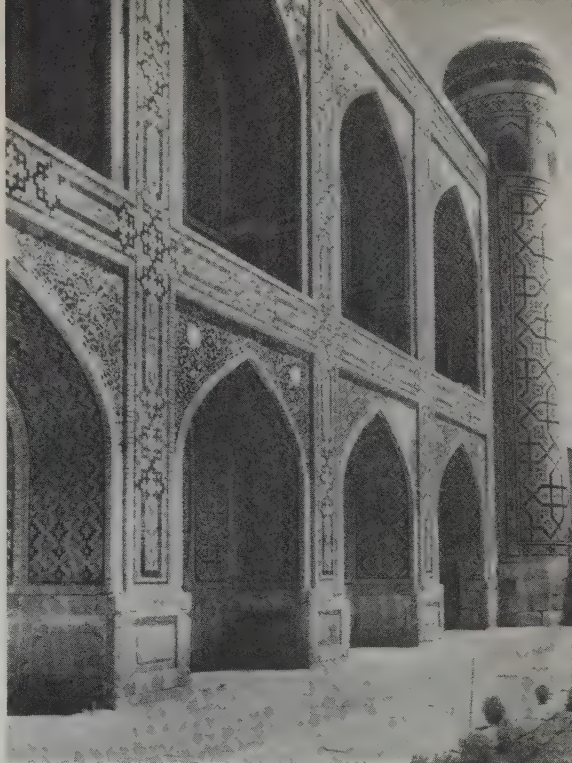


Illustration Research Service

Tilla-kari Madrasah, Samarkand, USSR, 17th century.

sian poetry. Without attempting to give a chronology of its major phases, it is possible to distinguish in it four major moods. In the first, or heroic, mood the illustration of Firdausi's great Persian epic, *Shah Nameh* (q.v.), provided occasions to depict the brilliant feats of princes and heroes of Persian antiquity, and to convey, through a mixture of artificial backgrounds and precision of detail, something of the legendary and yet deeply living character of the work. An excellent example of this style is provided by the manuscript known as the Demotte *Shah Nameh*, the separate leaves of which are now scattered throughout the world. The second, or lyrical, mood chose its themes from love stories and mystical poems. In it were developed motifs of permanently blooming gardens in which young and handsome princes held court or lovers met at night, and of brilliantly static throne scenes. A world of fantasy was created in which precision and inventiveness of detail were prized rather than originality of composition or of subject matter. A third mood is exemplified by Behzad (Bihzad, late 15th century), one of the earliest identifiable personalities of Persian art. Although there is much disagreement about what works should be attributed to him, one characteristic of his work was the introduction of realistic details, often taken from direct observation of men, into the formal stylized world of Persian painting. The fourth type of painting did not begin until the late 15th century and flourished mostly in the two following centuries. It consists chiefly of portraits of courtly personages, done in the same precise technique as the book illustrations, but often with a firm and subtle irony in the representation of the princes and princesses

of Iran. An interesting development of this later form was the introduction of more popular scenes: shepherds, washing women, and other subjects not usually found in earlier painting.

Although these four moods appeared chronologically in the approximate order in which they have been enumerated, the later moods were developed in addition to, rather than in place of, the earlier ones. In the art of the Safavid dynasty (1502-1736) they all appear in a perfection of color and design rarely achieved before.

Ottoman World.—In Anatolia and the Balkans power was in the hands of the Ottoman Turks, who conquered Constantinople (modern Istanbul) in 1453. Ottoman art derived from Byzantine, Seljuk, and Persian sources. The most characteristic mosques took over the ancient plan of Hagia Sophia (Saint Sophia) in Constantinople and transformed it into logically conceived and structurally perfect monuments, whose high domes flanked by slender minarets and adjoining courtyards with domed porticoes make up the magnificent skylines of Istanbul and other Turkish cities. Its style of painting was derived from Persian miniatures, but in its fascination with historical events and its greater realism in the representation of the background, it later moved away from its early models. While rarely attaining the formal perfection of Persian art, Ottoman art provides a running commentary on a brilliant history. In addition to its painting and architecture, Turkey had illustrious schools of ceramics and carpentry.

World of Muslim India.—The first large-scale Muslim penetration of India occurred in the 11th century, and a number of monuments show the amalgamation of Near Eastern and Indian motifs which began to take place at that time. However,

it is from the 15th century onward, when Persian artists were attracted to the Muslim courts in India, that India's greatest Islamic art was created. Its major characteristic is its highly successful blending of Persian and Indian traditions. In architecture, this can be seen in the celebrated mausoleum at Agra known as the Taj Mahal (q.v.; 1632-1653) whose harmonious perfection and ideal setting make it one of the world's great monuments. It is mostly in miniatures, however, that we see the Persian traditions of courtly, epic, and portrait painting infiltrated by a different spirit, whose greater interest in spatial representations, greater fascination with atmosphere and the transparency of textiles, and greater concern with individual actions led to an entirely new art. In its full realization this new spirit belongs to the tradition of Indian art rather than to Islamic art proper.

AESTHETIC VALUES OF ISLAMIC ART

While it is impossible in a brief survey to present every facet of an art which extended for 10 centuries from Spain to India, an appreciation of Islamic art requires the realization of two major facts. First, most Muslim art was created for the aristocratic taste of the courts; its miniatures reflected the idealized life of which Persian princes dreamed, and the artificial world whose changeless beauty the secular patrons of the arts sought to reproduce in the palaces. Even the great mosques are, in the final analysis, inspired less by the faith than by the glory of the princes who sponsored their construction, and it is mostly in the small sanctuaries and mausoleums that the depth and intensity of Muslim religion is evident. As a secular art, however, emphasizing luxurious life and a luxurious setting for life, Islamic art has had no equal: thus can be explained its tremendous impact on the art and on the way of life of Christian princes in the Middle Ages and later.

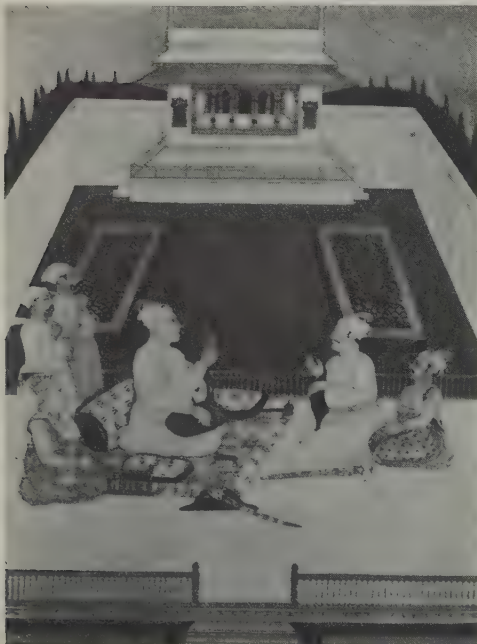
Second, Islamic art is essentially an art of artisans. Except in its later phases, when certain outstanding individuals appear among architects and painters, it was an art whose creators were more often fascinated by the technical possibilities of their media than by ideologies or by purely formal considerations. They vied with each other in inventing new subtleties in their use of standard iconographic motifs; and it is from this endless virtuosity of their creations, from their inventiveness in small details, and from the striking combinations of forms and themes of different origins that the greatness of Islamic art derives. Although Muslim artists achieved a powerful monumentality in such buildings as the mosques of Isfahan, Córdoba, and Istanbul, even in these buildings decorative values and the understanding of architecture as a means to enchant rather than as a means to impress have often given to the largest and most monumental Islamic creations a character of intimacy and of decorative excellence which has overshadowed their monumentality proper.

Other features of the intellectual, social, and historical development of the Muslim world have left their imprint on Islam's artistic production, but it is in these two that Islamic art finds at the same time its greatness and its limitations.

See also **ARCHITECTURE—Islamic; INDIA—7. Architecture and Art** (Art Following the Muslim Impact: 13th to 20th Century); **MIDDLE EAST**

Miniature painting, Bengal, India, early 18th century.

Victoria and Albert Museum



—21. *The Arts: Reaction Against Hellenism* (Islamic Art); MINARET; MOSQUE; PAINTING—*Eastern Art*; PERSIAN ART—*Mohammedan Period*; SYRIA—8. *Art and Architecture* (Islamic); TURKEY—*Arts and Literature*.

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ISLAMIC LITERATURE. Islamic literature may be defined as comprising the books of a religious character written by Muslims in the languages of Islam. This literature sprang out of the Koran (q.v.); the life, acts, and sayings of the prophet Mohammed (c. 571-632); and the religious experiences of his followers. Composed in both prose and verse, it has exercised a profound influence upon the secular writings of the Muslim peoples.

The Koran.—The primary religious document of Islam is the Koran, believed by Muslims to comprise the divine revelations received by Mohammed over a period of many years through the mediation of the archangel Gabriel, and collected by Mohammed's disciples shortly after his death from "scraps of parchment and leather, tablets of stone, ribs of palm branches, camels' shoulder blades and ribs, pieces of boards, and the breasts of men." The authorized text, with its division into 114 chapters (suras) of varying length and content, was established by order of the third caliph, Othman (r. 644-656). The Koran is composed in rhythmical and rhyming prose, held to be of miraculous and inimitable excellence. The interpretation of the Koran gave rise to a very extensive exegetic literature, and a very great number of commentaries—some extremely voluminous—have been produced from the early years of Islam down to the present day. The most esteemed are those written by the historian al-Tabari (838-923), which has been printed in 30 folio volumes, the grammarian al-Zamakhshari (1074?-1143), the philosopher Fakhr al-Din al-Razi (1149-1209), and the theologian al-Baidawi (d. ?1286). In modern times important commentaries have been written by the Egyptians, Muhammad Abduh (1849-1905) and Muhammad Rashid Rida (1865-1935) and the Indians, Sir Sayyid Ahmad Khan (1817-1898) and Abul Kalam Azad (1888-1958), among others.

Hadith.—The fundamental authority in questions touching the theology, ritual, and law of Islam is the Koran. However, the Koran was soon found to be far from providing the solutions for all problems arising out of the rapid spread of the faith, and the practice of the Prophet was looked to for filling the gaps. Details of his daily

life and casual sayings were eagerly preserved and transmitted, and out of this miscellaneous material the body of traditions known as the Hadith grew rapidly. Handed down orally for several generations by men scattered through the four quarters of the Muslim world, these traditions became exceedingly numerous and covered a great multitude of topics. From quite early times learned or pious individuals made collections of Hadith, but it was not until the rise of the law schools that the need was felt to arrange and codify, and to some extent to verify, the heterogeneous accumulations. The first *Musnad* or assemblage of testified traditions is assigned to abu-Hanifah (abu-Hanifa, 699-767), founder of the Hanafi law school. His initiative was soon followed by Malik ibn-Anas (715?-795), father of the Maliki school, whose compilation called *al-Muwatta'* (*The Leveled Path*) is the fundamental textbook of his school and has attracted many commentators. His disciple, al-Shafi'i (767-820) established a third codification, while Ahmad ibn-Hanbal (780-855) made a fourth, considerably larger than the preceding three. These last two works are the foundation documents of the Shafi'ite and Hanbalite schools of jurisprudence respectively.

The four founders of these law schools, and their colleagues of the Shi'ite persuasion and the lesser sects, were concerned to promulgate and arrange those traditions which had to do with the theory and practice of Islamic law. But countless Hadith unrelated to law were also in circulation, and in the 9th century six outstanding scholars worked to establish a canon of authentic traditions. First and most famous was the Persian, al-Bukhari (810-870), who is said to have sifted through several hundreds of thousands of traditions in the course of giving his approval to a mere 2,762. His contemporary, Muslim ibn al-Hajjaj of Nishapur (d. 875) compiled a similar collection, called, like that of al-Bukhari, *al-Sahih* (*The Genuine*), which is esteemed as second in authenticity only to al-Bukhari's work. The next generation produced supplementary compilations by abu-Dawud (817-889), al-Tirmidhi (d. about 892), ibn-Maja (d. 886), and al-Nasa'i (d. 915). These famous texts have provided Muslim scholars through all the succeeding centuries with plentiful material for comparison and commentary. Indeed, a high proportion of the extensive religious literature of Islam is devoted to exegesis of the Koran and commentary on the Hadith.

Biographies of Mohammed.—The biography of Mohammed engaged the attention of many writers who used similar traditional material to reconstruct the life of the founder of their faith. The first biography of the Prophet is that written by ibn-Ishaq (d. about 768), a recension of which was incorporated by ibn-Hisham (d. 834) into his own *Sira* (Biography). The historians al-Waqidi (747-823) and ibn-Sa'd (d. 845) devoted much care to the life of Mohammed, and their accounts were important sources for later chronologists such as al-Baladhuri (d. about 892), al-Tabari (838-923), and ibn-al-Athir (1160-1234). Derivative biographies of an increasingly hagiological character were written in Persian and Turkish, and the life of the Prophet has attracted a number of contemporary writers.

Theology.—Orthodoxy.—The spread of Islam soon led to a battle of sects and schisms, out of which the science of theology eventually de-

veloped. The foundations of orthodoxy were finally laid securely by al-Ash'ari (873/874-935/936), the father of Muslim scholasticism. Important works on comparative religion, in which Christian and Jewish as well as Islamic sects were discussed, came from the pens of ibn-Hazm of Córdoba (994-1064) and the Persian al-Shahrastani (d. 1153). Meanwhile, philosophy, stimulated by the translation into Arabic of the works of Plato, Aristotle, and their late Hellenistic commentators, had been pursuing a comparatively independent path with al-Kindi (d. about 870), al-Farabi (870?-950) and ibn-Sina (Avicenna, 980-1037), all of whom had paid at least lip service to Islam. In the 11th century, however, philosophy collided violently with theology, and al-Ghazzali (1058-1111), an eminent jurisconsult as well as theologian and mystic, wrote the *Tahafut al-Falasifa* (*Incoherence of the Philosophers*) to "demolish" the constructions of the Islamic philosophers. He was answered from Morocco by ibn-Rushd (Averroës, 1126-1198) in his *Tahafut al-Tahafut* (*The Incoherence of the Incoherence*), but his reply was little heeded and theology prevailed, the more so when the Syrian, Ahmad ibn-Taymiyah (1263-1328), renewed the onslaught and silenced the philosophers for centuries to come.

Sufism.—A middle way between rationalism and dogma was discovered by the Sufis, the mystics of Islam. Their ascetic mode of life, allegedly modeled on that of Mohammed, brought them ecstatic experiences out of which they developed a theory of the "path to union with the Divine." Sufism soon produced an abundant literature in both prose and verse. Lives of the saints were written in all the languages of Islam, notably by al-Sulami (d. 1021), abu-Nu'aim al-Isbahani (d. 1038), and al-Sha'rani (1493-1565), in Arabic; and by the mystical poets, Farid al-Din 'Attar (d. about 1220) and Jami (1414-1492), in Persian. There also exist many biographies of individual mystics and of members of the dervish confraternities. The discipline and doctrines of Sufism were established primarily by writers such as al-Muhasibi (d. 857), al-Junaid (d. 910), al-Hallaj (858-922), and al-Tirmidhi (fl. 900); they were further developed and systematized by al-Sarraj (d. 988), abu-Talib al-Makki (d. 996), al-Kalabadhi (d. about 1000), al-Qushairi (986-1072), and the Persian, Hujwiri (d. about 1075). The reconciliation between orthodox theology and Sufi doctrine was worked out by al-Ghazzali in a number of works, above all in the *Ihya'* (*Revivification*) and the *Kimiya-yi Sa'adat* (*Alchemy of Happiness*, a Persian digest of the *Ihya'*).

After al-Ghazzali very many Sufi works were written; it is possible only to mention the leading authors. Abu Isma'il al-Ansari (1005-1088) wrote devotional works in Arabic and highly esteemed prayers in Persian. Muhi al-Din al-Jilani (1078-1167) wrote many books, including sermons and prayers. Shihab al-Din al-Suhrawardi al-Maqtul (executed for blasphemy in 1191 at the age of about 37), attempted to reconcile philosophy and mysticism; in addition to numerous learned Arabic treatises he composed mystical allegories in Persian. His namesake, Shihab al-Din al-Suhrawardi of Baghdad (d. 1234), founded the Suhrawardi order of dervishes. Muhi al-Din ibn-'Arabi (1165-1240), who was born at Murcia and died in Damascus, wrote well over two hundred books expounding his deep and original theosophy, as well as much mystical poetry; his main works are the *Fusus al-Hikam* (*Bezels of*

Wisdom) and *al-Futuhat al-Makkiya* (*Meccan Revelations*). The theme of divine love (the lover and the beloved) was treated in a series of delicately expressed Persian treatises by Ahmad al-Ghazzali (d. 1126), Fakhr al-Din 'Iraqi (d. about 1290), and Jami. Sufi works of various kinds abound also in Turkish, Pashto, Urdu, and Malay. Among the later writers the most original and voluminous was the Egyptian, al-Sha'rani (d. 1565), who among other things composed his autobiography.

Religious Poetry.—Religious poetry, much of a very high order, abounds in the languages of Islam. During Mohammed's lifetime devotional poems were written in defense of the new religion, and panegyrics composed in honor of its founder; the most famous of these was the work of Ka'b ibn-Zuhair. This celebrated paean is exceeded in popularity only by the *Burdah* (*Cloak*) of the Egyptian al-Busiri (1213-c. 1296), commemorating a miraculous cure from paralysis following a vision of Mohammed; the poem itself was afterwards believed to possess magical qualities, and it has been repeatedly calligraphed and imitated. Most Persian epics begin with long sequences on the unity of God and the virtues of His Prophet. The life and miracles of Mohammed inspired the Turkish poet, Sulaiman Chelebi (d. 1421), to write his *Mevlidi Sherif* (*Nativity Ode*) which is still recited on certain religious festivals. Religious and ascetic themes dominate the poetry of abu 'l-'Atahiya (748-826). Most of the Arab mystics wrote verses of a metaphysical or ecstatic kind; the greatest among them being the Egyptian ibn-al-Farid (1181-1235), whose longest composition, the *Nazm-al-Suluk* (*Poem of the Way*), runs to 760 couplets all rhyming on the same letter.

Poetry in Persian is largely religious and mystical in character. To the national poet, Firdausi (c. 940-c. 1020), is attributed an epic on the story of Joseph and Potiphar's wife, based upon sura 12 of the Koran; and the same subject was afterwards treated by numerous Persian and Turkish poets, among them Jami, who gave it a mystical turn. The Ismaili propagandist, Nasir-i Khusrau (1003-1061), composed many fine religious poems. Sana'i (fl. 1131) wrote a long epic on the mystical life with illustrative anecdotes, as well as a kind of *Pilgrim's Progress*. Farid al-Din 'Attar composed many long mystical poems, some in the form of allegories; the best known of these is his *Mantiq al-Tair* (*Speech of the Birds*), of which a greatly abridged paraphrase was made by Edward FitzGerald, the translator of Omar Khayyám. Beyond dispute the finest mystical poet of Islam, and perhaps of the world, was Jalal al-Din Rumi (1207-1273), founder of the Mawlawi (Mevlevi) order of whirling dervishes. His *Mathnawi*, in about 25,000 couplets, ranges widely over the mystical life and experience, and is far superior to Sana'i's earlier work; a complete English translation was made by Reynold A. Nicholson. Rumi also composed over two thousand odes, many of considerable length and all of a mystical character, said to have been dictated in a state of trance. His biography was written in verse by his son, Sultan Walad.

Mystical quatrains have been composed by many poets, including abu-Sa'id ibn Abi 'l-Khair (967-1049); the wandering dervish, Baba Tahir (fl. 1030), who wrote in Persian dialect; Farid al-Din 'Attar; and Rumi. Fine

mystical lyrics were written by 'Iraqi, Baba Kuhi (d. 1050), Ibn Yamin (1286-1367), Qasim al-Anwar (1356-1433), and many others; mystical ideas also permeate the poetry of Sa'di (1184?-1292) and Hafiz (c. 1326-1389). The last great Persian mystical poet was Jami, who wrote several religious epics, including the *Salaman u Absal* which FitzGerald put into English.

Of the many poets who composed on mystical topics in the Turkish language, the best esteemed is the 14th century writer, Yunus Emre (d. 1320?); others include Gulshehri (14th century) 'Ashiq Pasha (1272-1337), Nesimi (executed in 1404), and Fuzuli (1494-1555).

In modern times little religious poetry of importance has been written in Islam. An interesting exception is Muhammad Iqbal (1876-1938) of Lahore, in present West Pakistan. Following in the footsteps of reformers like Sir Sayyid Ahmad Khan and Muhammad 'Abduh, he used the medium of Persian verse to disseminate his philosophical and political ideas of a revitalized and reunited faith.

See also ARABIC LITERATURE; INDIA—13. *Religion and Philosophy* (Islam); ISLAM; KORAN; PAKISTAN—9. *Literature*; PERSIAN LITERATURE; SUFISM; TURKISH LITERATURE; and biographies of important authors mentioned.

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ISLAND, i'länd, a body of land entirely surrounded by water. Islands are usually classified as continental or oceanic. Continental islands rise from an underwater shelf extending from the mainland, and so have rock structure, fauna, and flora similar to that of the mainland. They are formed in several ways. When coastal lands are submerged by subsidence of the land or raising of the sea level, high points protruding above the encroaching ocean become islands. The British Isles, for example, were once a part of continental Europe, and many of the islands off the coasts of Scandinavia and northern North America were formed by submergence. Earth movements may separate a body of land from the mainland, as in the case of Madagascar, which was cut off from continental Africa by the sinking of a long, narrow strip of land called a rift valley. Wave action often wears away weak rock formations along the seacoast, so that the more resistant rocks become islands. The Isles of Shoals off the coast of New Hampshire are the result of such erosion. Ocean currents sometimes build up new islands by depositing sand and other debris offshore. Fire Island, off Long Island, New York, was formed in this way.

Oceanic islands are usually surrounded by deep water, far distant from continental shores; they are generally volcanic or coralline in structure and have a limited flora and fauna. The Hawaiian

Islands, Samoa, Fiji, and other large islands of the central Pacific were built up from the ocean floor by volcanic action until they rose above sea level. Mauna Kea on the island of Hawaii rises nearly 32,000 feet from the floor of the sea, making it the highest mountain in the world. The coral atolls characteristic of the islands of Micronesia in the western Pacific were formed by coral growth along the fringe of subsiding volcanic islands until the original islands had become completely submerged and only the coral rings remained. (See also CORAL AND CORAL REEFS.)

Australia is sometimes called the world's largest island, but it is usually classed as a continent, with its own continental shelf and associated islands such as New Guinea. Greenland is generally regarded as the largest true island.

ISLAND NUMBER 10, The Siege of, the first Civil War engagement in the campaign of the Union forces to divide the Confederacy by seizing control of the Mississippi River. After the capture of Fort Donelson (q.v.) on Feb. 16, 1862, the Union fleet of gunboats and mortar boats, commanded by Flag Officer Andrew H. Foote, steamed down the Mississippi to assist Maj. Gen. John Pope in taking Island Number 10. Situated in a bend of the river in northwestern Tennessee, the island was protected by 49 guns and 12,000 men, including those on the opposite Tennessee shore, and by a nine-gun floating battery. On the night of April 6, four of Pope's river transports bypassed the Confederate position by way of a shallow channel cut through the swamps in the bend adjacent to the island. The deciding factor in the siege, however, was the action of the Union gunboats *Carondelet* and *Pittsburgh*, which passed the Confederate batteries at night and provided a covering fire while Pope's troops crossed the Mississippi below Island Number 10, captured the Confederates' mainland positions, and seized the only route of escape from the island. On April 7, 1862, Island Number 10 surrendered, with a loss to the Confederates of over 5,000 men captured and large quantities of arms and equipment. The island no longer exists, having been washed away by river action after the Civil War.

ISLAY, i'lā, island, Scotland, the most southerly of the Inner Hebrides off the west coast of Argyll, Scotland. Islay is about 14 miles west of Kintyre Peninsula and lies southwest of Jura, from which it is separated by the Sound of Islay. With an area of nearly 234 square miles, the island is hilly in the east, rolling or level in the west. The chief town is Port Ellen, which is a noted golfing resort. The industries of the island include fishing, farming, whiskey distilling, and quarrying. Islay was formerly the seat of the Lords of the Isles (Macdonald clan). Pop. (1951) 4,267.

ISLE LA MOTTE, il'lä möt', island, Vermont, in the northern part of Lake Champlain, about 10 miles south of the Canadian border. The island is six miles long and two miles wide. It was discovered by Samuel de Champlain in July 1609, and was named after a French officer, Captain Sieur de la Motte, who about 1665 erected a small wooden fort, called Fort Ste. Anne, on the south shore for protection against Mohawks. On Aug. 8, 1776, Benedict Arnold, after engaging the Indians in the British service on August 6,

at the Bouquet River, fell back to Isle La Motte, where his fleet remained anchored until August 19, when he sailed south toward Cumberland Head. Isle La Motte was settled in 1785 by Ebenezer Hyde, Enoch Hall, and William Blanchard, and was organized as a town in 1790. The quarries of black marble on the island are the oldest in the United States.

ISLE OF MAN, Great Britain, an island in the Irish Sea, 16 miles south of Burrow Head, Wigtownshire, 221 square miles in area. It is 33 miles in length, and 12 miles in breadth at the widest point. A range of mountains crosses the island from northeast to southwest, culminating in Snaefell, 2,034 feet in height. The coast is rugged and precipitous in the southwest. Granite, red sandstone, limestone, and slate are quarried for building purposes. The air is dry, clear, and bracing, and much southern vegetation grows freely here, owing to the warm currents of the Gulf Stream which envelop the shores. Agriculture is the main industry. There are also woollen mills where the famous "Manx homespun" is made; and woollen knitted goods are produced. Ruins of ancient churches and chapels, castles, and fortresses dating from the 5th century are found throughout the island. Manx, the branch of Celtic formerly spoken by the people, is no longer in general use. The Isle of Man was subject to Scandinavian rulers from the 9th century until 1266, when it was ceded to Scotland. In 1399 it came into possession of the English crown. The legislature (Tynwald) consists of a Legislative Council and the House of Keys. The Council is composed of the lieutenant governor of the island, the bishop of Sodor and Man, 2 deemsters (judges), the attorney general, and 6 nominated members, of whom 2 are nominated by the lieutenant governor and 4 by the House of Keys; this latter body has 24 elected members. Douglas is the capital of the Isle of Man; and Castletown, Peel, and Ramsey are ports. Pop. (1951) 55,213.

ISLE OF PINES (Span. ISLA DE PINOS, ēz'la thā pē'nōs), a small island belonging to Cuba, 35 miles southeast of Pinar del Rio, 1,180 square miles in area. Nueva Gerona, the capital, is on the north coast. It is, in effect, two islands connected by a marsh, the one on the north being somewhat broken by hills and that on the south being low, flat, and sandy. The climate is healthful, and the fertile soil produces citrus fruits, pineapples, and potatoes. Mineral resources are extensive. Large marble quarries are worked. Cattle raising is the chief occupation of the people. For administrative purposes the island is a municipal district of the province of Havana. The island was discovered by Columbus in 1494. The United States Supreme Court ruled in 1907 that the island was not United States territory; this was ratified by the United States Senate in 1925, thus recognizing that the Isle of Pines was part of Cuba. Pop. (1953) 10,105.

ISLE OF WIGHT, wit, England, off the south coast, separated from Hampshire by the Solent and the Spithead. It is 23 miles from east to west, and 13 miles from north to south, the area being 147 square miles. The island, the ancient Vectis, is rich in antiquities, having

been inhabited in turn by the Romans, the Jutes, and the Danes. Cowes, the chief port, is the yachting center of England. Agriculture and fishing are of importance, and the island is a popular vacation resort. Pop. (1951) 95,594.

ISLE ROYALE, il' roi'āl (Fr. ēl' rwā-yāl'), an island in Lake Superior, southeast of Port Royal, Canada, part of the State of Michigan. It is 44 miles long and 8 miles wide, and has an area of 229 square miles. Prehistoric copper mines have been found. In 1940 the island was dedicated as a national park.

ISLES OF SHOALS, New Hampshire, a group of eight barren islands in the Atlantic Ocean, 10 miles southeast of Portsmouth, N. H., from which a daily steamer plies during the summer months. The three principal islands are Appledore (400 acres); Star (150 acres) and White (55 acres).

ISLES OF THE BLEST, or FORTUNATE ISLANDS, according to Greek mythology and legend an island group on the edge of the western ocean, where dwelt those fortunate beings on whom the gods bestowed immortality. Hesiod mentions the group, as do later authors. It is supposed that the idea of this paradise on an island group is due to the remembrance of an unrecorded voyage to Madeira and the Canary Islands, these being called Fortunate Islands in some medieval maps.

ISLETA, ēs-lā'tā, N. Mex., Indian pueblo in Bernalillo County, on the Rio Grande 10 miles south of Albuquerque, served by the Santa Fe Railroad. It is in the Isleta Reservation. Pop. 756.

ISLINGTON, iz'ling-tōn, England, a metropolitan borough of London, 2 miles north of Saint Paul's. Within it are the Royal Agricultural Hall, Pentonville and Holloway prisons, and several hospitals and educational institutions. Pop. (1945) 195,770; (1951) 235,645.

ISLIP, i'slip, town, New York, in Suffolk County, Long Island, on the shore of Great South Bay; it is served by the Long Island Railroad. Oyster fishing and agriculture are of importance, and the town is a popular summer resort. In the vicinity is a state hospital for the insane. The town is named for Islip, Oxfordshire, whence came the first English settlers in the 17th century. Villages within the town include Islip, East Islip, Central Islip, Sayville, Bay Shore. Pop. 172,959.

ISMAIL, is-mā'el (Arab ISMĀ'ĪL), Arab religious leader: d. 760. He was the eldest son of Jafar al-Sadiq, sixth imam (q.v.) of the Shi'ite Muslims, and was originally chosen by his father to succeed to the imamate. When Jafar was told that Ismail drank wine, however, he altered his choice in favor of his second son, Mūsa al-Kāzim. The majority of the Shi'ite sect accepted the change, but others, claiming Ismail was infallible, adhered to him as the seventh imam, though he died five years before his father. His followers, known as Ismailites (q.v.) or Seveners (adherents of the seventh imam), continue to number in the millions in Islam in the 20th century.

ISMAIL I, is-mâ-êl', shah of Persia, founder of the Safavid (Safawid) dynasty: d. Ardebil, Iran, 1524. He was a descendant of Sheikh Şafî-al-Dîn (1252-1334), a holy man of the Shi'ite Muslims, and named his dynasty after Şafî, who claimed descent from the seventh imam and hence from Ali, Mohammed's son-in-law. In 1502, Ismail assumed the title of shah and succeeded in establishing an independent national government, the first since the Arab conquest of Persia in the 7th century. His capital was at Tabriz in Azerbaijan, of which province he was a native. He made Shi'ism the state religion, and during the first 12 years of his reign added considerably to his dominions, conquering Baghdad, Iraq, in 1508 and overwhelming the Uzbeks in Khurasan in 1510. In August 1514, however, he was beaten at Chaldiran by the Ottoman Turks under Selim I, losing his capital temporarily to the invaders. He was succeeded by his son Tahmasp I, Ismail II (r. 1576-1577) was his grandson. See also PERSIA-IRAN—9. *History* (Safavids).

ISMAIL PASHA, is-mâ-êl pá-shâ, khedive of Egypt: b. Cairo, Egypt, Dec. 31, 1830; d. near Constantinople (now Istanbul), Turkey, March 2, 1895. He was the son of Ibrahim Pasha (q.v.) and nephew of Said Pasha (q.v.), whom he succeeded as Turkish viceroy in Egypt in 1863. By increasing the Egyptian tribute to Turkey, Ismail won from the sultan the right of succession from father to son in the vicerealty of Egypt, and was given the title of Khedive (1866). Determined, like his grandfather Mohammed (Mehemet) Ali, to modernize the country, he launched an ambitious program of public works and cultural improvements, including schools for girls, a national library, and a national geographic society; during his reign the Suez Canal was completed (1869) and Egyptian rule was extended to southern Sudan and along the Red Sea coast. To finance his projects, Ismail borrowed heavily from foreign sources, especially English and French; and when his credit was exhausted, he sold Egypt's share (over 40 per cent) in the Suez Canal Company for about £4 million. To guarantee repayment of the loans Ismail had made, Great Britain and France took control of Egypt's finances in 1876 and placed their own ministers in the government. When Ismail attempted to withdraw these concessions, the two powers persuaded the Turkish sultan to remove him (June 1879) as khedive in favor of his son Mohammed Tewfik Pasha (q.v.).

ISMAIL PASHA, Hungarian-Turkish general. See KMETY, GYÖRGY.

ISMAILIA, iz-mâ-i-lê-â, town, Egypt, on Lake Timsah, the central station on the Suez Canal, 45 miles northwest of Suez and 93 miles northeast of Cairo by rail. Founded in 1863, it was built as construction headquarters for the canal and named after Ismail Pasha. It has docking facilities, warehouses, and factories producing confectioneries and electric light bulbs. It is connected with Cairo also by the Ismailia Canal, built to provide water to villages along the Suez Canal and now used mainly for irrigation purposes, although it is navigable. Pop. (1947) 53,594; with suburbs, 68,338.

ISMAILITES, is'mâ-i-lîts (also ISMAILIAUS; Arab. sing. ISMÂ'ILÎ), a Shi'ite Muslim

sect, also called Seveners because they revere Ismail (q.v.) as the seventh, greatest, and last imam in the true lineage of Mohammed, and believe that he will come again. The Neo-Isma'ilites, a militant terrorist group which originated in northern Iran about 1090 and spread to Syria, became known as the Assassins (q.v.). The Isma'ilites proper number today about 20 million. Aga Khan IV, previously Prince Karim, became their spiritual leader and 49th imam on the death of his grandfather, Aga Khan III (q.v.) in 1957.

ISMAY OF WORMINGTON, iz'mâ, wûrm'ing-tûn, 1ST BARON (HASTINGS LIONEL ISMAY), British general: b. Naini Tal, India, June 21, 1887. The younger son of Sir Stanley Ismay, he attended the Royal Military College at Sandhurst, was commissioned in the British Army in 1905, and between 1914 and 1920 fought in Somaliland, East Africa, where he led a camel corps column in 1920 against the "Mad Mullah," Mohammed ibn-Abdullah. He fulfilled assignments in India during the next few years and in the early 1930's, and served in London with the Committee of Imperial Defence as assistant secretary (1926-1930), deputy secretary (1936-1938), and secretary (1938).

At the outbreak of World War II, Ismay was appointed (1940) deputy secretary for the military to the war cabinet and chief of staff to the Ministry of Defence, headed by Prime Minister Winston Churchill. Knighted in 1940 and promoted full general in 1944, he accompanied Winston Churchill to all major war conferences of Allied leaders. He retired from the army in 1946 and received a barony for his wartime services in 1947. In 1951, Lord Ismay was appointed secretary for Commonwealth relations in Churchill's cabinet and a year later he became the first secretary general of the North Atlantic Treaty Organization and vice chairman of the North Atlantic Council. He retired from office in 1957.

ISNARD, ês-nâr', Maximin, French political leader: b. Grasse, France, Feb. 16, 1755; d. there, March 12, 1825. A perfumer at Draguignan, he was elected in 1791 to the Legislative Assembly, where he joined the ranks of the Girondists, the moderate republican party. Re-elected to the National Convention in 1792, he voted for the execution of Louis XVI in January 1793 and served on the Committee of General Defense until its dissolution in April. Opposing the demands of the more radical Jacobins, he was finally ordered arrested in October, but was able to hide with friends until the Reign of Terror ended in July 1794, after which he was recalled to the National Convention. He served (1795-1797) on the Council of Five Hundred, one of the legislative bodies under the Directory, and later supported Napoleon I and Louis XVIII, escaping the prosecution of Convention regicides in 1816.

ISOBAR, i'sô-bâr, in chemistry, a term applied to atoms having the same mass but different atomic numbers. The term was unknown in chemistry until the discovery of isotopes (q.v.), since each element was thought to be made up of atoms of the same mass. The simplest example of isobars is that of an isotope of helium and one of hydrogen. Helium with two protons and one neutron in the nucleus is He³, while the isotope of hydrogen which has one proton and two neutrons in its nucleus is tritium, H³. A special case is

that of "isobaric isotopes," in which a single element may exist in two forms with the same atomic weight and the same atomic number. One form loses gamma rays only to produce the second, which in turn disintegrates to produce another element in the usual radioactive fashion. The two have different half lives.

W. T. READ.

ISOBAR, in meteorology, a line on a weather map passing through points of equal barometric pressure, after reduction thereof to sea level or some other constant-altitude equivalent. Isobars are averaged curves, usually drawn on surface or upper-air charts for each 3 or 5 millibars of atmospheric pressure difference. See also METEOROLOGY.

ISOCLINES. See FOLDS.

ISOCLINIC LINES, i-sô-klin'ik, on geomagnetic charts, lines passing through all points on the earth's surface at which the inclination or dip of a magnetic dipping needle (q.v.) is the same. See also TERRESTRIAL MAGNETISM.

ISOCRATES, i-sôk'ra-têz, Athenian orator and rhetorician: b. Athens, Greece, 436 B.C.; d. there, 338 B.C. His inclusion in the ancient canon of the so-called Ten Attic Orators was not on account of his publicly pronounced orations, for his weak voice and natural nervousness hindered him from speaking often in public; but his speeches, composed for others to deliver, were considered the most artistic specimens of Attic Greek. His extant addresses avoid hiatus, crasis (vowel contractions), and dissonance, and are distinguished for their purity of diction, harmonious rhythm, elaborate periods, and symmetrical structure.

Beyond his mastery of the rhetorician's craft, Isocrates' claim to fame rests on two other foundations: his pedagogy and his patriotism. In his school of oratory (c. 392-c. 350 B.C.) at Athens, he trained almost all the noted Greek orators, politicians, philosophers, and historians of the 4th century B.C. These pupils—each in his own way—developed the principles taught by Isocrates and through these precepts profoundly influenced Greek (and, afterward, Latin) prose. Three centuries later, Marcus Tullius Cicero, Rome's greatest orator, characterized the school as "the laboratory of eloquence"—perhaps the best tribute ever paid to Isocrates' instruction.

In politics Isocrates looked beyond the independent, provincial Greek city-state to a Hellenism with a worldwide mission. He espoused the establishment of peace and unity among the warring city-states and advocated the adoption of a common cause which would weld the Greeks into a nation. This plan inspired Philip II, king of Macedon (r. 359-336 B.C.), to unite the Greek city-states into a Panhellenic union to conquer the East. Philip's death did not delay his program, which was completed by his son Alexander III the Great (r. 336-323 B.C.). His successors, Seleucids in Asia and Ptolemies in Africa (Egypt), continued for three centuries the Hellenization of those areas with such success that Greek culture persisted in the East, even after the Roman conquest, until it gradually was submerged by the rising tide of Islam, which began to beat upon it in the 7th century.

Of the 60 orations attributed to Isocrates in

antiquity, only 28 were accepted as authentic; 21 survive together with 9 letters, mostly addressed to kings. His speeches fall into the following categories: (1) educational—two discourses criticizing other disciplines and commending his own method; (2) forensic—six speeches for clients in private lawsuits; (3) hortatory—three orations on morals; (4) epideictic—three encomiums, of which the one on Evagoras, king of Salamis in Cyprus (r. 411-374 B.C.), is the earliest Greek biography extant; and (5) political—six addresses on government and policies (mainly Athenian), of which the *Panegyricus*, the *Areopagiticus*, and the *Panathenaicus* are the most celebrated. Besides these orations and letters we have 26 titles and 41 fragments of other orations and 6 short quotations from a lost treatise on the art of rhetoric.

The best Greek edition with English translation is by George Norlin and Larue van Hook, *Isocrates* (3 vols., 1928-45).

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P. R. COLEMAN-NORTON.

ISODYNAMIC LINES, i-sô-dî-nâm'ik, on geomagnetic charts, lines passing through all points possessing equal values of horizontal intensity in the earth's magnetic field. See also TERRESTRIAL MAGNETISM.

In climatology, isodynamic lines on a climatic chart of a region are lines which pass through places having equal average surface wind velocities.

ISOGLOSS, i'sô-glôss, in linguistics, a plotted line on a map marking the limits within which certain languages, dialects, or types of pronunciation are used. Refinements of the isogloss are the *isolex*, to mark areas where identical words are used; *isophone*, marking areas of identical pronunciation; *isotax*, for areas with identical syntactical features; and *isoseme*, indicating areas of identical meaning.

ISOGONIC LINES, i-sô-gôn'ik, on a geomagnetic chart, lines passing through all points having equal magnetic declination (or variation); that is, all points where a magnetic compass needle has the same angular departure from a true north-south plane. Magnetic declination is caused by the fact that the earth's north and south magnetic poles do not coincide with the geographic poles, but lie equatorward of these true poles in both cases. The curved line passing through all points of zero magnetic declination (that is, where the direction of the geographic poles coincides exactly with that of the magnetic poles) is termed the *agonic line*. Two sections of this line exist, in the Western and Eastern hemispheres respectively. At any point east of the American agonic line, between it and the looping Eurasiatic-Australian section, a compass points west of the geographic pole in either northern or southern latitudes; westward from the American agonic line in both latitudes, as well as north of the central Asiatic loop, a compass points east of the geographic pole. Magnetic declinations increase up to a maximum of 180°, east or west, as indicated by the isogonic lines. See also COMPASS, MAGNETIC; TERRESTRIAL MAGNETISM.

FERGUS J. WOOD.

ISOLATING LANGUAGES. See GRAMMAR; LANGUAGES OF THE WORLD—*Methods of Classification*.

ISOLATING MECHANISMS, ī-sō-lāt-īng mēk'ā-nīz'ms, in biology, barriers which prevent or curtail the exchange of genes between populations of sexually reproducing organisms. Such isolating mechanisms may be spatial, as when the populations inhabit separate geographical territories; or they may stem from genetically determined properties of the populations which result in a failure of interbreeding even among populations coexisting in the same territory. A primary distinction can thus be drawn between geographical isolating mechanisms and reproductive isolating mechanisms. The former are characteristically present between races of one species; the latter are developed between species. Reproductive isolating mechanisms can be further subdivided into external and internal barriers, depending on whether the gene exchange is blocked before or after cross-fertilization between individuals of the different populations. Examples of external reproductive isolation are the adaptations of different populations to different ecological niches, the occurrence of the mating or flowering periods at different seasons, and specific courtship patterns which stimulate sexually only individuals of the same species. Failure of the sperm or pollen to function in the sexual ducts of another species, inviability of hybrids, and hybrid sterility exemplify the class of internal reproductive isolating mechanisms. See also EVOLUTION.

VERNE GRANT.

ISOLATION, in biology. See ISOLATING MECHANISMS.

ISOLATION, ī-sō-lā'shūn, in physics and chemistry, the separation of one object, material, or substance from its surroundings, for purposes of examination, identification, or use. The first method of isolation which naturally comes to mind involves the difference in density between two or more materials. In metallurgy, for example, a dense material like native gold can be isolated in water by grinding ore or taking already finely divided sand or silt from stream beds and agitating the mixture so that the gold settles to the bottom, while the lighter material floats away. On the other hand, gold may be dissolved in cyanide solutions or in metallic mercury, with which it forms an amalgam. In the course of a large-scale cyaniding operation, it is necessary to get rid of two materials—a coarse grit and a fine slime—before the gold can be isolated from solution. In a piece of chemical engineering equipment known as a classifier, the two are agitated by rakes, which move the solid up an inclined plane in partial suspension in the solution. The “fines” float away in one direction, to be separated subsequently from the liquid by settling, while the grit is raked over the upper edge of the sloping floor of the classifier.

Rare-earth elements are isolated as soluble compounds by virtue of the difference between the rates of adsorption in a column of an inert material. Electrical charges imposed on small particles bring about isolation of dusts and mists from gases as they pass through a corona discharge; the solids and liquids go to a discharge electrode, leaving a harmless gas to escape into the air.

All qualitative and quantitative analysis, and all organic preparations, to say nothing of most chemical engineering processes, depend on the phenomena of isolation, in which one substance is dissolved, or converted to another derivative which it insoluble. To determine the chloride-ion content of a solution, insoluble silver chloride is isolated, dried, and weighed. Magnesium, present in very low concentration in sea water, is converted by lime to insoluble magnesium hydroxide, which is isolated by filtration for subsequent conversion to the chloride, and thence to the metal.

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ISOLATIONISM, ī-sō-lā'shūn-īz'm, in diplomacy, a policy of maintaining a nation's rights and interests without alliances. When a nation's geopolitical position is such that it can do so, it is in a fortunate situation, because alliances always involve one in the diplomatic liabilities of one's allies and have to be paid for with diplomatic equivalents. Japan, before its pact with Great Britain in 1902, lived without allies for a thousand years, during the last half century of which it grew to world power. Great Britain lived from 1822 to 1902 in “splendid isolation” with only *ad hoc* (temporary) allies, except for a dormant traditional alliance with Portugal. The United States dwelt successfully in diplomatic isolation from 1800 to 1917—if not, indeed, to 1941. Its experience is an example of some of the national isolationist trends of the 19th century.

American Isolationism: 1776-1900.—Up to the time of the American Revolution the English colonists in North America, remote though they were from England, had no concept of isolation. They regarded involvement in Great Britain's wars with European states and colonies as an inevitable dispensation of fate, never to be questioned. It took a liberal English isolationist and recent immigrant to the colonies to awaken them to the idea that one of the advantages of independence was separation from Britain's wars and quarrels with other peoples. “Any submission to or dependence upon Great Britain,” Tom Paine reminded his American readers in *Common Sense* (1776), “tends directly to involve this country in European wars and quarrels and sets us at variance with nations who would otherwise seek our friendship and against whom we have neither anger nor complaint.”

American diplomacy at the outset of the Revolution was so set against alliances that the Continental Congress resisted any commitment to France binding the two nations not to make a separate peace. Nevertheless, the need for military assistance overcame the revulsion to an alliance, without which the War of Independence would not have succeeded. The Franco-American alliance of 1778 entangled the United States in France's commitments with other allies (notably Spain, Convention of Aranjuez, 1779) during both the peace negotiations of 1782 and the wars of the French Revolution, and this experience disillusioned American statesmen after independence had been achieved.

President George Washington in his classic *Farewell Address* (1796), drafted by Alexander Hamilton, counseled his fellow countrymen to steer clear of foreign entanglements: “The great rule of conduct for us, in regard to foreign nations, is in extending our commercial relations, to have with them as little *political* connection as

possible. . . . Europe has a set of primary interests, which to us have none, or a very remote relation. Hence she must be engaged in frequent controversies the causes of which are essentially foreign to our concerns. Hence, therefore, it must be unwise in us to implicate ourselves, by artificial ties, in the *ordinary* vicissitudes of her politics, or the *ordinary* combinations and collisions of her friendships or enmities." President Thomas Jefferson echoed this advice in his inaugural address of 1801: ". . . peace, commerce, and honest friendship with all nations, entangling alliances with none." President James Monroe re-echoed the policy of Washington and Jefferson in his famous message to Congress of Dec. 2, 1823, known since 1852 as the Monroe Doctrine. Recalling the two separate spheres of polity laid down for the New World and the Old World, he declared: "In the wars of the European powers, in matters relating to themselves, we have never taken part, nor does it comport with our policy, so to do. *It is only when our rights are invaded, or seriously menaced* that we resent injuries, or make preparations for our defense"

The United States had considered its neutral rights invaded by France in 1796–1798 and had prepared for defense to the extent of a quasi war with that former ally; but it is noteworthy that in that emergency both Congress and President John Adams rejected any idea of an alliance with France's enemy Great Britain. In the years 1806–1812 the United States had considered its sovereign rights invaded by British maritime measures and the practice of impressing seamen, and had gone to war finally in the hope of conquering Canada, and also Florida which belonged to Britain's ally Spain. But the student of diplomatic isolation must note that President James Madison's government rejected any idea of an alliance with Britain's deadly enemy France under Emperor Napoleon I.

The isolationist foreign policy of the United States was remarkably successful throughout the 19th century and well into the 20th. Its success can be explained by the following geopolitical circumstances and factors: (1) the country occupied a detached and distant position; (2) Europe's distresses were America's advantage, leaving the Continental powers little energy for adventures in North America; and (3) Canada was in effect a hostage for good relations with Great Britain, the only power that was in a position to make war on the United States. Isolation was successful, in short, because of the foolproof geopolitical situation of the United States. That it was foolproof is attested by the fact that it was able to indulge in a great civil war without any permanent harm to its foreign policy.

Changes Since 1900.—This happy condition changed at the beginning of the 20th century with the rise of Germany and Japan as world powers on the opposite side of each ocean, each with a first-class army, each building a first-class navy, and neither with a hostage like Canada for good conduct toward the United States. On the contrary, the United States had given a hostage to Japan by the acquisition of the Philippine Islands (1898).

Americans were slow to realize the implications of this new world picture of power and politics. Isolation persisted as a policy until Germany finally challenged President Woodrow Wilson's defense of neutral rights by proclaiming unrestricted submarine warfare on Jan. 31,

1917. Isolation broke down during the joint war effort of 1917–1918, but even then the United States made no alliances with Germany's enemies; President Wilson insisted that the partners of the United States in the war were associates, not allies. After the war, when American rights and interests seemed no longer menaced, the nation reverted to complete diplomatic isolation by rejecting the Treaty of Versailles and the Covenant of the League of Nations and repudiating, in the neutrality legislation of 1935–1937, Wilson's whole system of diplomacy.

Only when American rights and interests were menaced by the conquests of dictators Adolf Hitler and Benito Mussolini and their Tripartite Alliance of 1940 (with Japan), the United States again prepared for defense and deserted the outworn tradition of isolation. The changing geopolitical situation made it no longer safe to live without allies; in the face of the postwar menace of the Soviet Union and its Eurasian allies, it became even more dangerous.

"We have pinned our hopes to the banner of the United Nations," President Harry S. Truman declared to Congress on Jan. 14, 1946, after the defeat of Germany and Japan. From 1947 to 1955 a spectacular revolution in American foreign policy, backed by bipartisan domestic political support, resulted in defensive regional alliances with 44 sovereign nations, within the purview of Article 51 of the United Nations Charter. In the atomic age, isolation has become a thing of the past.

As to cultural isolationism, there has never been much in the history of the United States. No people has been more influenced by foreign cultures than the people of the United States, and in recent years no people has had greater influence on other peoples and nations. Contemporary examples of cultural isolation are found, however, in the Communist regimes of Russia, China, and their satellites, which mold their cultures and even their science to their own political concepts, insulated from outside cultures by the Iron Curtain and Bamboo Curtain.

See also CANADA—44. *Canada, Britain, and the Commonwealth* and 45. *External Relations*; UNITED STATES—20. *International Relations and Diplomacy* and the following sections on history.

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ISOLD, ISOLDE, ISOLT. See TRISTAN.

ISOMERISM, i-sōm'ēr-iz'm, a term used in chemistry to describe the phenomenon in which two or more compounds have the same elements, the same percentage of each element, and the same

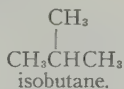
molecular weights, but show differences in either physical properties, chemical properties, or both. Such compounds, called isomers, possess identical molecular formulas but have different structural formulas; that is, the atoms are arranged or united in different ways in the molecules constituting each isomer. The phenomenon is of frequent occurrence, and isomeric compounds are known in both organic and inorganic chemical fields. There are two main types of isomerism exhibited by organic compounds: simple structural isomerism and stereoisomerism.

Simple Structural Isomerism.—Under this heading are four kinds of compounds.

Carbon-skeleton isomers differ primarily in the arrangement of the carbon atoms. For example, there are two butanes with the molecular formula C_4H_{10} whose structural formulas are:



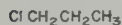
n-butane



isobutane.

There are 3 isomeric pentanes with the molecular formula C_5H_{12} ; 5 isomeric hexanes (C_6H_{14}); 9 isomeric heptanes (C_7H_{16}); 18 isomeric octanes (C_8H_{18}); and 35 isomers of C_9H_{20} . Most of these are known. As the number of atoms in the molecule increases, the number of isomers increases. Mathematical calculations indicate there should be 366,319 isomers of $C_{20}H_{42}$ and 6.25×10^{19} isomers of $C_{40}H_{82}$. Only a few of these are known.

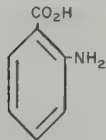
Position isomers are compounds with the same carbon skeleton, but the substituent atoms or groups occupy different positions. Some examples are:



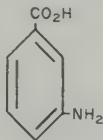
1-chloropropane



2-chloropropane



o-aminobenzoic acid



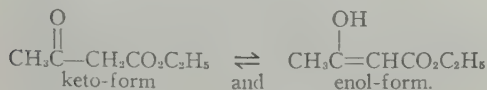
m-aminobenzoic acid



p-aminobenzoic acid

Functional group isomers consist of compounds with the same molecular formula but different functional groups; that is, they belong to different homologous series. For example, ethanol (CH_3CH_2OH) is isomeric with methyl ether (CH_3OCH_3); both have the molecular formula C_2H_6O .

Tautomers are also functional group isomers, but these are in dynamic equilibrium with each other. For example, ethyl acetoacetate ($C_6H_{10}O_3$) exists as an equilibrium mixture of

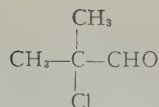


These tautomeric isomers have been separated.

Combinations of the above are also known. For example, two of the many isomers of C_4H_7ClO are:



4-chloro-2-butanone

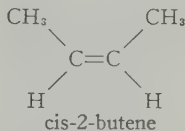


2-chloro-2-methylpropanal.

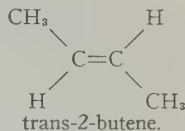
These differ in the carbon skeleton, functional groups, and position of attachment of the halogen.

Stereoisomerism.—Isomeric compounds are known which have the same carbon skeleton and the same functional groups attached in the same positions but which show experimental differences in certain physical and/or chemical properties. To explain this phenomenon, it is necessary to postulate differences in the three-dimensional space arrangements of the atoms or groups within the molecules. Two main types of stereoisomers are known: geometric isomers and optical isomers.

Geometric isomers owe their existence to the fact that atoms or groups occupy fixed positions in space when attached to two doubly bound atoms or to certain cyclic structures. For example, 2-butene (C_4H_8) exists in two geometric isomeric forms:

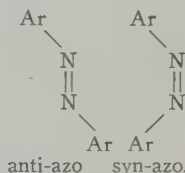
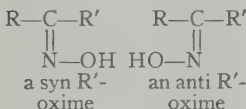


cis-2-butene



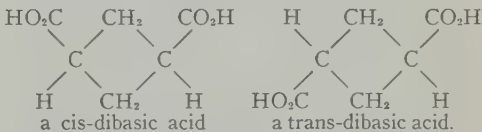
trans-2-butene.

The presence of the double bond fixes the positions of the methyl radicals and hydrogen atoms and prevents rotation or exchange of groups. The first structure has the two hydrogen atoms on the same side of the double bond; hence the prefix *cis*-. In the second formula the hydrogen atoms are across from each other; hence the prefix *trans*-. The doubly bonded atoms can involve elements other than carbon. For example:

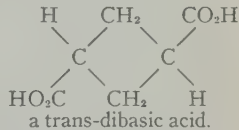


anti-azo *syn*-azo.

Cyclic structures also constitute a fixed spatial reference system so that geometric isomers can arise, as in the following:



a *cis*-dibasic acid

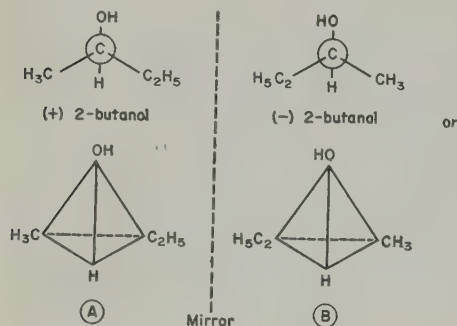


a *trans*-dibasic acid.

Other molecular structures are known which orient attached groups in definite spatial positions which give rise to geometric isomers.

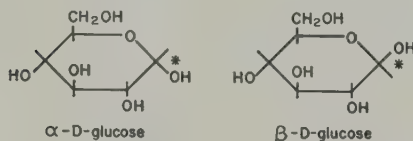
Optical isomers are of two types, enantiomorphous isomers and diastereomers. The first type, enantiomorphous, is characterized by a molecular structure such that it possesses a nonsuperposable mirror image. Such molecules may contain an asymmetric carbon atom; that is, a carbon

atom linked to four different radicals (Joseph LeBel, Jacobus van't Hoff, 1874). To express the three dimensional arrangements possible it is necessary to use space models or projections of these. As an example of enantiomorphs, the optical isomers of 2-butanol ($\text{CH}_3\text{CHOHC}_2\text{H}_5$) may be illustrated, using the van't Hoff concept of a tetrahedral carbon atom.



Inspection of the models (A) and (B) shows that they are mirror images of each other but are not identical because the figures are not superposable (that is, not congruent). Such isomers resemble each other very closely and can be distinguished from each other only by their influence on plane-polarized light using an instrument called a polarimeter. One isomer, marked (+), rotates the plane of vibration of polarized light in a clockwise direction and is denoted as dextrorotatory; the mirror image, (-), rotates the plane counterclockwise and is called levorotatory. When careful measurements are made using the same length of tube containing the liquids (or solutions of the same concentration) at the same wavelength of light and same temperature, it is found that the degrees of rotation are equal in magnitude but opposite in direction. It is from this physical property (optical effects) that the isomers are called optical isomers. The central asymmetric atom need not be carbon; it can also be nitrogen, silicon, arsenic, or any other element whose valences are tetrahedrally directed.

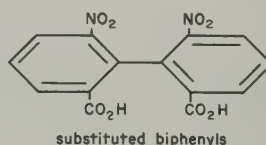
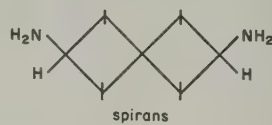
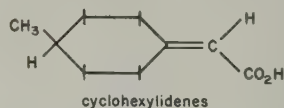
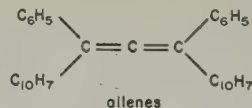
Diastereoisomers (or diastereomers) are optical isomers but not enantiomorphs. For example, ordinary corn sugar, glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) exists in two diastereomeric forms:



The two forms differ only in the configuration about the carbon atom marked with the asterisk; the α -form has an optical rotation of $+112^\circ$ whereas the β -form rotates polarized light $+18.7^\circ$. The structures are not mirror images. These diastereomers in the sugar series are also called anomers.

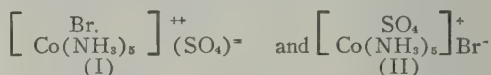
An asymmetric atom is not essential for the existence of optical isomers; any three-dimensional structure with proper substituents which possesses a nonsuperposable mirror image can

exhibit optical isomerism. Optically active isomers (+) and (-) have been obtained from allenes:



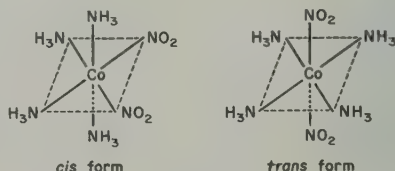
They have also been obtained from other three-dimensional compounds such as substituted phenanthrenes, tri-*o*-thymotide, arylolefins, polynuclear aromatic hydrocarbons, ansa compounds, and hexasubstituted cyclohexanes (inositols, benzene hexachloride).

Inorganic compounds also exhibit the phenomenon of isomerism, most of the examples being in the field of coordination compounds. An example of structural isomerism is shown by the two coordination compounds of cobalt:



In compound (I) the bromine is in the cation and the sulphate group is the anion; whereas in structure (II), the bromine is the anion and the sulphate group is in the cationic complex.

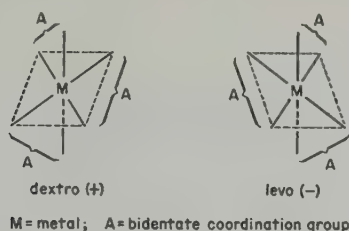
Coordination compounds of cobalt, in which six groups are attached to the central cobalt atom by bonds which are directed to the apexes of an octahedron, can also exist in geometric isomers. For example:



Elements with a planar distribution of valences also exist as geometric isomers. For example, cis- and trans-isomers of nickel bis-benzylmethylglyoxime, of the palladous complex with glycine, and the platinum complexes with pyridine and dialkyl sulphides are known.

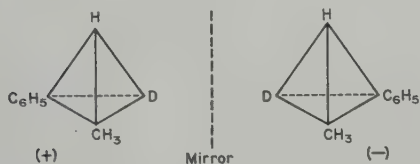
Many examples of optical isomers of complex compounds of Co, Al, As, Ir, Rh, Cr, Fe, Pt, and Zn are known. These are also octahedral coordina-

tion complexes in which the central metal is attached to six groups. When these are properly chosen, structures possessing nonsuperposable mirror images result, and optical isomers become possible. One example may illustrate the three-dimensional structure for dextro- and levo-isomers of this type.

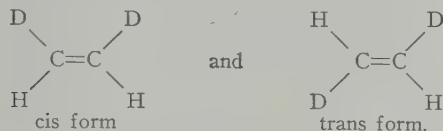


Modern usage excludes the phenomena of polymerism and polymorphism as subdivisions of isomerism. Polymers constitute a class of high molecular weight substances characterized by the presence of structural repeating units; they do not fall under the definition of isomers. Polymorphism is related to the crystalline state.

All these types of isomers are composed of ordinary elements with ordinary isotopic composition, as the materials available from plants, animals, and their remains (coal, petroleum). Isotopic compounds such as CH_4 and CD_4 are not isomers; their percentage composition and molecular weights are different. Likewise, $\text{CH}_3\text{O}^{16}\text{H}$ and $\text{CH}_3\text{O}^{18}\text{H}$; C^{12}O_2 and C^{14}O_2 ; and N^{14}H_3 and N^{15}H_3 are classed as different compounds and not as isomers. The presence of an isotopic form of an element can give rise to isomers in certain structures. For example, optical isomers of $\text{C}_6\text{H}_5\text{CHDCH}_3$ are known because of the asymmetric carbon atom (*) which gives rise to nonsuperposable mirror image structures.



Likewise, cis- and trans-isomers may exist in isotopically substituted olefins such as:



See also AROMATIC HYDROCARBONS; CARBON COMPOUNDS; CHEMICAL CRYSTALLOGRAPHY—*Applications of Crystallographic Methods to Chemical Problems*; STEREOCHEMISTRY.

Bibliography.—Gilman, Henry, and others, eds., *Organic Chemistry*, vol. 1, chap. 4 (New York 1943); Wheland, George W., *Advanced Organic Chemistry* (New York 1949); Noller, Carl R., *Chemistry of Organic Compounds*, chap. 17 (Philadelphia 1951); Bailar, John C., ed., *Chemistry of the Coordination Compounds* (New York 1956).

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ISOMORPHISM, i-sô-môr'fiz'm, signifying a similarity in form between things, a term used in (1) crystallography, mineralogy, and chemistry; (2) biology; (3) mathematics.

In crystallography, mineralogy, and chemistry, isomorphism means a similarity of crystalline form between substances of analogous chemical constitution. The word was introduced by Eilhardt Mitscherlich in 1819, but the phenomenon had been discovered in 1812 by William Hyde Wollaston, who observed that crystals of the carbonates of barium, strontium, and lead, for instance, are very similar in shape, and that the interfacial angles are very similar though not identical. We now know, as a result of X-ray diffraction studies, that this similarity of crystal shape arises from a very close similarity in the arrangement of the atoms.

The recognition of the phenomenon of isomorphism was of great importance in the development of chemistry in the 19th century. In a pair of isomorphous crystals it was assumed that the atoms were present in the same relative numbers, so that if the valences of the atoms in one crystal were known, those in the other could be inferred. In this way the isomorphism of sodium sulphate and sodium selenate led to the correct valence and thence to the correct atomic weight for selenium, and the isomorphism of the minerals vanadinite and apatite led to the classification of vanadium with phosphorus in group 5 of the periodic table.

Crystals of substances of analogous chemical constitution are not necessarily isomorphous: crystals of MgCO_3 , ZnCO_3 , FeCO_3 , and MnCO_3 for instance, though they form an isomorphous group (of rhombohedral symmetry) among themselves, are quite different from those of BaCO_3 , SrCO_3 , and PbCO_3 , which have orthorhombic symmetry. The difference of crystal structure arises from a difference in the sizes of the metal ions in relation to the carbonate ion: small metal ions pack with carbonate ions to give a rhombohedral arrangement, while larger metal ions give a quite different orthorhombic arrangement. The calcium ion is of intermediate size, as a result of which CaCO_3 can assume either of these structures; this is an example of isodimorphism.

Some substances which form isomorphous crystals can also crystallize together as "mixed crystals" containing both substances; in simple ionic crystals this occurs only if the corresponding ions have the same valence and do not differ in radius by more than about 15 per cent. Thus K_2SO_4 and Rb_2SO_4 form mixed crystals, since the monovalent metal ions are closely similar in size; but NaNO_3 and rhombohedral CaCO_3 (a closely isomorphous pair) do not form mixed crystals, because the ions are monovalent in NaNO_3 but divalent in CaCO_3 . The classification of minerals largely depends on isomorphous relations and the formation of mixed crystals; in certain complex minerals, especially silicates, the limitations of valence, ionic size, and relative numbers of the different atoms are less stringent, and there is, for instance, a complete range of mixed crystals of the triclinic feldspars albite $\text{NaAlSi}_3\text{O}_8$ and anorthite $\text{CaAl}_2\text{Si}_2\text{O}_8$.

Isomorphism is of great importance in the determination of the atomic positions in complex crystals by X-ray diffraction methods. A powerful direct method is based on a comparison of the diffraction patterns of a pair of isomorphous crystals containing ions of very different diffracting power; such a comparison leads to a

knowledge of the phases of the diffracted waves and thence to the calculation of a detailed image of the structure. The method was first used for the alums and for phthalocyanine and its derivatives. See also CHEMICAL CRYSTALLOGRAPHY.

In biology, isomorphism is a similarity of form between organisms of different ancestry, resulting from convergence due to similarity in habits or environment.

In mathematics, isomorphism is similarity of form and of operations between different groups. See also EQUATION—2. *Galois Theory of Equations* (Isomorphic Fields); GROUPS, THEORY OF—*Isomorphisms*.

Consult Tutton, Alfred E. H., *Crystallography and Practical Crystal Measurement*, 2d ed., 2 vols. (London and New York 1922); Dana, Edward S., *Textbook of Mineralogy*, 4th ed. (New York 1932); Wells, Alan F., *Structural Inorganic Chemistry*, 2d ed. (London 1950); Lipson, Henry S., and Cochran, William, *The Determination of Crystal Structures* (London 1953).

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ISONZO RIVER, ê-zôn'tsô or **SOCA RIVER**, sô'châ (ancient SONTIUS), a river in northwest Yugoslavia and northeast Italy, 84 miles long, rising in the Julian Alps in Slovenia and flowing generally southward past Kobarid (Ital., Caporetto) and Tolmin in Yugoslavia, and Gorizia in Italy, to the Gulf of Trieste in the Adriatic Sea, 12 miles northwest of Trieste. In World War I the Isonzo Valley was the scene of many battles between the Italians, whose territory it then was, and the Austrians and Germans. After World War II, at the Conference of Paris in 1946, most of the Isonzo Valley (above Gorizia) was given to Yugoslavia, where the river is known as the Soča.

See also WORLD WAR I—9. *Italian Front* (First Four Battles of the Isonzo) and (Fifth Battle of the Isonzo).

ISOPODA, i-sôp'ô-dâ, an order of Crustacea under the subclass Malacostraca. The body is dorsoventrally flattened. A head with eyes and antennae and mouth parts underneath is followed by seven free thoracic segments, all or some of which bear a pair of walking legs; after this comes an abdomen of six segments, often indistinct through fusion, bearing flattened leaflike respiratory and swimming appendages. These animals are generally small, the size of insects, but a deep-sea form reaches a foot in length. The group varies greatly in form and mode of life, having marine, fresh-water, terrestrial, and parasitic members. The majority are marine and are common along shores, hiding under objects or living among seaweeds. One marine isopod, *Limnoria*, known as the gribble, is, despite its minute size, very destructive to piling by burrowing into the wood. Parasitic forms include the scarcely altered Cymothoidae, infesting fishes and whales, and the much altered Cryptoniscidae and Bopyridae, parasites of other crustaceans. The terrestrial isopods are the familiar sow bugs or pill bugs, flattened gray creatures found under flowerpots, boards, fallen logs, and the like, some of which roll themselves up like an armadillo on disturbance. The similar fresh-water isopods are common in ponds and streams. Isopods in general are scavengers, feeding on corpses and decaying matter. They breed only by the sexual method; the sexes are separate and distinguished by differences in the form of some of the appendages.

The eggs are brooded in a brood chamber, formed by basal expansions of some of the thoracic legs, and hatch as young isopods.

Consult Richardson, Harriet, *A Monograph on the Isopods of North America*, United States National Museum, Bulletin No. 54 (Washington 1905); Van Name, Willard Gibbs, *The American Land and Fresh-Water Isopod Crustacea*, The American Museum of Natural History, Bulletin No. 71 (New York 1936).

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The American Museum of Natural History.

ISOSTASY, i-sôs'tâ-sî, in geology and geodesy, the tendency of adjacent portions of the earth's crust to seek an equilibrium state of balance by adjusting their varying weights of rock material against the downward force of gravity. Although several hypotheses concerning the nature of this dynamic action were earlier proposed, the term "isostasy" was first used by an American geologist, Clarence E. Dutton, in 1889.

The principle of isostasy is somewhat analogous to that of a balance scale. As the pan of one side is overloaded, it sinks under the action of gravity. In compensation, the opposite pan rises until its load is so adjusted that a state of equilibrium is reached, after which no further vertical displacement takes place. The theory of isostasy similarly assumes the disposition of certain naturally occurring excesses and deficiencies of density in the earth's outer rock mantle to make such a balanced condition possible.

Early surveys by Pierre Bouguer (1698-1758) in the Andes of Peru and by the English mathematician Joseph H. Pratt (1811-1871) in the Himalaya Mountains of India revealed that the attraction of these great masses for a pendulum was considerably less than it should have been according to the theory of gravitation. From this fact it was later deduced that a condition of isostatic compensation must prevail in the earth's crust, in which a rock material of lesser density lies beneath upthrust surface features and a material of greater density exists beneath land depressions and oceanic basins.

According to the "roots of the mountains" theory proposed by Sir George Biddell Airy in 1855, the continental crust of the earth consists chiefly of rock material rich in silica and alumina (termed, from the first two letters of each word, the *sial*), which because of its lesser density "floats" on a heavier layer of magmatic material rich in silica and magnesium (termed the *sima*) which also predominates beneath ocean basins. The first of these two layers is principally granitic in composition; the second is primarily basaltic. (See BASALT; GRANITE.) The principle by which isostatic balance is achieved by this sialic layer through varying degrees of downward penetration into the sima is shown in Fig. 1.

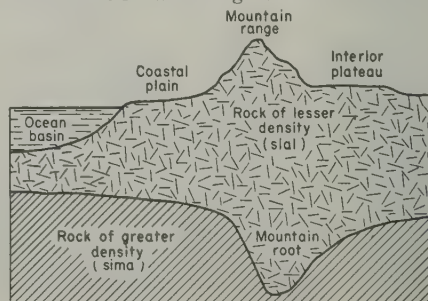


Fig. 1. Airy theory of isostasy.

A second theory of isostasy proposed by Pratt in 1856 assumes that the density of land masses of differing heights is compensated at a uniform depth by underlying land blocks having various densities and volumes, as depicted in idealized form in Fig. 2.

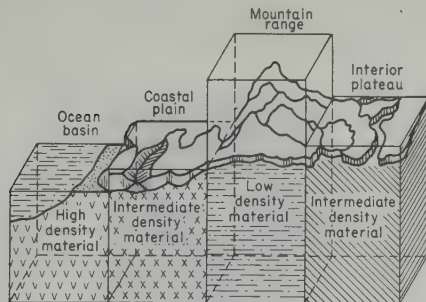


Fig. 2. Pratt theory of isostasy.

Modern studies of isostasy are carried out by the Isostatic Institute of the International Association of Geodesy in Helsinki, Finland. New data were also found by seismic and gravimetric studies in the International Geophysical Year (q.v.). See also EARTH, THE—*Earth's Constitution*.

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ISOTOPES, ī'sō-tōps, in chemistry and physics, atoms of the same chemical element having the same atomic number but different radioactive properties and atomic weights. For many years it was believed that all atoms of a particular element were identical in size and atomic weight. Early in the present century, however, the existence was established of several groups of radioactive elements having different radioactive properties and atomic weights, but identical chemical behavior. This led Frederick Soddy to describe these elements as isotopes (from Gr. *isos*, equal, + *topos*, place), since the elements within each group occupied the same place in Dmitri Ivanovich Mendeleyev's periodic table (see PERIODIC LAW). The existence of stable isotopes was suggested by the work of Joseph John Thomson on positive rays from the gas neon (1913), and the subsequent development of the mass spectrograph by Francis William Aston in 1919 quickly led to confirmation that most chemical elements consist of mixtures of a few isotopes, the atomic weight of the element being the mean weight of the atoms of that element.

Modern physical theory suggests that the atom consists of a dense nucleus surrounded by a cloud of electrons describing orbits around the nucleus. The nucleus is an assembly of neutrons and protons, both called nucleons, which are particles of nearly equal weight. The neutron, as the name suggests, is a neutrally charged form; the proton carries a unit positive electrical charge. The electrons are light particles weighing little more than $\frac{1}{2000}$ part of the weight of a proton (nucleon), and carrying a unit negative charge. The number of orbital electrons equals the number of protons in the nucleus so that the atom as a whole is electrically neutral. The number of protons determines the nuclear charge as well as the number of orbital electrons, and therefore the

chemical behavior of the atom; the number of neutrons determines the isotopic weight. Thus the isotopes of an element consist of atoms having within their nuclei the same number of protons but different numbers of neutrons. An isotope is normally specified by the chemical symbol which determines the nuclear charge, together with a superscript which specifies the mass number or the total number of nucleons in the nucleus. For example, Mg^{24} specifies the isotope of magnesium (charge 12 units) which has 24 nucleons, that is, 12 protons and 12 neutrons. The symbol is sometimes written as $^{24}_{12}\text{Mg}$. As an example of the physical differences between chemically identical isotopes, the lighter uranium isotope U^{235} , when extracted by a mass spectrograph or other means from relatively harmless natural uranium, becomes one of the materials from which an atomic bomb may be constructed. This is because it is able to undergo a fast fission chain reaction.

In addition to the stable and radioactive isotopes occurring in nature, many more radioactive isotopes can be produced artificially. In 1934, Irène Curie and her husband Frédéric Joliot-Curie produced artificially a radioactive isotope of phosphorus (P^{30}) by bombarding aluminum with alpha particles (helium nuclei consisting of two protons and two neutrons). Thereafter many more artificial radioactive isotopes were discovered. Enrico Fermi showed that slow neutrons are particularly effective as bombarding particles in this connection, since they are uncharged and easily enter a nucleus and become part of it, producing a different isotope. Vast quantities of radioactive isotopes are now produced by this method in nuclear reactors or piles. Many of these, now available at reasonable cost, are used in industry as well as in science and medicine.

One of the first uses of radioactive isotopes was as tracers; natural radioactive isotopes were used in this way by Georg von Hevesy and Friedrich Adolf Paneth in 1913. The radioactive tracer atoms are, so to speak, labeled by the radiations which they emit. They can move about in chemical and biological processes just as the other nonradioactive atoms of the same element. The position of the labeled atoms can, however, be determined with great sensitivity at some later time by the detection of the radiations emitted, and so can demonstrate the movement or exchange of atoms in the process being studied. As an illustration, radioactive phosphorus (P^{32}) has been used by surgeons to determine the position of brain tumors. The tumor tissue selectively absorbs phosphorus from the blood stream, so that if a little radioactive phosphorus is introduced it tends to migrate to the tumor and to betray its presence by its radioactivity. Radioactive tracers have also been used for studying wear in engine cylinders, the migration of insects, and many other interesting problems.

Radioactive sources of very high intensity can be produced artificially in a reactor. Radioactive cobalt (Co^{60}) has now largely supplanted radium and other natural radioactive elements in radiotherapy because, in addition to emitting radiations of a suitable nature for this work, it can be produced in a convenient mechanical form and is comparatively cheap. Similar strong sources of radiation are finding uses in radiography, in sterilization of foodstuffs, in reducing static electricity in industrial processes, and in many other fields.

See also ATOM—*Isotopes*; CHEMISTRY; FALL-

CHEMISTRY; ELEMENT; GAMMA RAY; MOLECULAR THEORY—*Structure of Molecules* (Experimental Molecular Structure); NUCLEAR ENERGY; RADIOACTIVITY; RADIOCHEMISTRY.

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Bibliography.—Extermann, Richard C., ed., *Radioisotopes in Scientific Research*, 4 vols. (Oxford 1958); Kistemaker, J., and others, eds., *Proceedings of International Symposium on Isotope Separation* (New York 1958); Whitehouse, W. J., and Putnam, J. L., *Radioactive Isotopes: an Introduction to Their Preparation, Measurement and Use*, rev. ed. (New York and London 1958); Overman, Ralph T., and Clark, Herbert M., *Radioisotope Techniques* (New York 1960); Hevesy, Georg von, *Adventures in Radioisotope Research: Collected Papers*, 2 vols. (London 1962).

ISOUARD, ē-zwâr', Nicolò (known professionally as NICOLÒ, NICCOLÒ and NICOLÒ DE MALTE), Maltese-French composer: b. Malta, Dec. 6, 1775; d. Paris, France, March 23, 1818. After serving as organist of the Church of St. John of Jerusalem in Malta, he went in 1799 to Paris, where he became a successful operatic composer. Of his approximately 40 operas, the best known are *Cendrillon* (1810), *Joconde* (1814), and *Jeannot et Colin* (1814). He also composed church music.

ISPAHAN. See ISFAHAN.

ISRAEL. See JACOB.

ISRAEL, Manasseh ben. See MANASSEH BEN ISRAEL.

ISRAEL, ʔz'ri-ël, ancient kingdom. See JEWISH HISTORY AND SOCIETY—1. *History: From Traditional Beginnings to the French Revolution* and 4. *Kings and Prophets*.

ISRAEL, a republic of southwestern Asia, proclaimed on May 14, 1948, upon the termination of the British mandate over Palestine. It is bounded on the north by Lebanon, on the east by Syria and Jordan, on the southwest by the United Arab Republic, and on the west by the Gaza Strip and the Mediterranean Sea. The total area is 7,993 square miles, or about three fourths that of the former mandate. As of Jan. 31, 1963, the population was estimated at 2,338,000. The capital is Jerusalem,¹ with a population of 167,435 at the 1961 census. Other large cities, with their 1961 populations, are Tel Aviv-Jaffa (386,070), Haifa (183,031), and Ramat Gan (90,841). The national flag contains the six-pointed star of David set between two horizontal blue stripes on a white field. The national anthem is *Hatikvah*, with words by Naphtali Herz Imber.

The land, people, economy, culture, and history of Israel are discussed under the following headings:

- | | |
|-------------------------------|--------------------------------|
| 1. The Land and Its Resources | 4. Education and Cultural Life |
| 2. The People | 5. Government |
| 3. Economic Activities | 6. History |
| | 7. Bibliography |

1. THE LAND AND ITS RESOURCES

In shape, Israel is an irregular, narrow strip

¹On Dec. 9, 1949, the United Nations General Assembly declared Jerusalem to be an international area under the UN Trusteeship Council. Both Israel and the Hashemite Kingdom of Jordan (formerly Transjordan) rejected the United Nations resolution, and Jerusalem remained divided between the Israeli-held New City and the Old City, held by Jordan.

approximately 265 miles long, extending from the Galilean hills in the north to the port of Elath (Eilat) in the extreme southeast. The highest altitude is at Mount Jarmaq (Meirun, Meron), a 3,963-foot peak in upper Galilee; the lowest is along the shores of the Dead Sea (1,292 feet below sea level), the lowest point on the world's surface. Israel's coastline on the Mediterranean Sea extends for 117 miles; on the Dead Sea, for 35 miles; and on the Red Sea, for 6 miles.



National emblem

Mountain and plain, lake and seacoast, field and desert vary Israel's landscape. Newly productive soil adjoins barren stretches, sharpening the contrasts produced by the rapid reclamation of wasteland. From the coastal plain—warm and moist in summer, mild in winter—the land rises eastward to the Judean heights and then drops markedly to the hot and dry Jordan Valley. In the south lies the Negev (Negeb) Desert, constituting about half the area of the country. Hot and dry in summer, cold and dry in winter, the Negev is Israel's chief frontier area. In the north are the Galilee hills, warm and dry in summer, cold and rainy in winter; and the rich agricultural lands of the Jezreel Valley, reclaimed from malarial swamps.

Israel's chief source of mineral wealth is the Dead Sea, of which 108 square miles lie within its territory. The sea's abundant chemical deposits yield potash, caustic soda, magnesium, and bromine. The country also possesses ingredients for cement and other building materials, ceramic clays and glass sand, mica, barite, feldspar, sulfur, peat, and papyrus. Copper lies in the hills of the southern Negev, and deposits of phosphates, kaolin, and iron ore have been found. Commercial exploitation of petroleum began at Helets (Helez), near Ashkelon, in 1955.

See also DEAD SEA; JORDAN RIVER.

2. THE PEOPLE

Population Trends.—At the proclamation of the state in 1948 the Jewish population approximated 655,000. An unprecedented wave of immigration resulted in a doubling of the population within three years. By the time of the census of May 22, 1961, the population totaled 2,183,332, including 247,134 non-Jews. Hebrew is the official language of the country and also the common language of the majority of the people. The non-Jewish population consists chiefly of Arab Muslims in rural villages in Galilee and elsewhere and of about 27,000 Bedouins.

Despite the establishment of many new rural settlements in the Negev and elsewhere, approximately 33 percent of the population in 1961 lived

in the three major cities of Tel Aviv-Jaffa, Haifa, and Jerusalem; 44 percent, in other towns and townships; and 23 percent, in the countryside. Vital statistics reflect the predominantly urban and Western character of the Israelis, as well as the effectiveness of medical and health facilities. The crude birth rate in 1961 was 25.4; the death rate, 6.0; and the infant mortality rate, 31.4. The average life expectancy at birth for the Jewish population in 1960 was 70.7 years for males and 73.5 for females.

Immigration.—In accordance with its policy to "welcome home every Jew who seeks entry," the new nation accepted 700,000 immigrants in the first four years of its existence. The majority of the Jewish population under the British mandate had come from the Jewish centers of eastern and central Europe during the waves of Zionist settlement between World Wars I and II. In the period 1948-1951 the greatest proportion of immigrants (about 45 percent) also came from eastern Europe, but an increasing number arrived from Asia and northern Africa, where the surge of Arab nationalism threatened many of the ancient Jewish communities. By late 1951 the rate of influx had lessened, and in succeeding years the number of newcomers rose and fell, partly reflecting political conditions in the countries of origin.

The vast and sudden influx in the first few

available. The principal role in the practical work of immigration, absorption, and agricultural settlement has been undertaken by the Jewish Agency, the division of functions between the agency and the government of Israel having been defined in the World Zionist Organization Law of 1952 and a covenant of 1954.

Religion.—The great majority of the inhabitants are of the Jewish faith, but only a relatively small proportion of the population accepts the full orthodox code and ritual. Questions of religious control in education, personal status (chiefly marriage and divorce), observation of kosher food laws and of the Sabbath, and recruitment of women for national defense are often important national issues. The Israeli government, through the Ministry of Religious Affairs, assists and safeguards the Jewish, Muslim, and other religious communities in the conduct of religious affairs and the maintenance of places of worship. Religious officials are paid by the government. Autonomous religious courts of the respective communities have jurisdiction in matters of personal status. The non-Jewish population in 1961 included about 172,000 Muslims (mainly of the Sunnite sect), 52,000 Christians (mainly Greek Catholics and Greek Orthodox), and 24,000 Druzes (Druses). Haifa is the spiritual center of the Baha'i faith. Freedom of worship exists for all groups.

3. ECONOMIC ACTIVITIES

Israel's economy is characterized by an intensive agriculture and by highly specialized light industries. State enterprises, accounting for about 20 percent of all industry, are engaged mainly in the exploitation of natural resources in the Negev. Cooperative and collective organizations are important, particularly in agriculture. Histadrut, the largest labor organization, owns and operates about 15 percent of the nation's industry. As a whole, however, private enterprise is predominant. Dependent on imports for most of its raw materials and many of its foodstuffs and manufactures, the young nation has had to adopt heroic measures to sustain its growing population by developing its internal resources and increasing its output for foreign markets. To encourage private investment, both domestic and foreign, an investment center was established by a law of 1950 (amended in 1955 and 1959), and advantages were offered investors in the form of tax concessions, depreciation allowances, currency transferability, and the right to withdraw profits from the country.

In the first 13 years after the establishment of the state, Israel's population grew by an average of 7 percent annually. The output per worker, however, not only remained undiminished, but rose markedly in this period, reaching an average annual rate of growth of 5 percent in the later years. With foreign aid and investment supplementing domestic capital, the gross national product increased by an average of 10.7 percent annually in the period 1950-1961, one of the highest rates in the world. Despite the almost threefold increase in population from 1948 to 1962, the standard of living rose by more than 50 percent per capita. The austere conditions of the early 1950's were succeeded in the 1960's by a level of living that compared not unfavorably with that of most western European countries.

Industry.—Though lacking the resources for large-scale heavy industry, Israel possesses important assets in its skilled labor force and abundant chemical deposits. The largest industrial



Rapho Guillumette

Magen David Adom Square in Tel Aviv. This modern city is an industrial and commercial center.

years of the nation's life created a multitude of problems of adjustment and absorption. Among the newcomers were numerous sick and aged persons incapable of self-support. Many immigrants had to acquire new skills and learn a new language. The customs and attitudes of some of the newcomers, particularly those from Africa and Asia, differed considerably from the predominantly European ways of the rest of the population. Within a few years hundreds of thousands of persons had passed through the hastily constructed reception centers and *ma'barot* (transition camps). After 1954 most of the new arrivals went directly to towns or villages, where housing and jobs were



Youths at a school of agriculture for boys and girls at the kibbutz of Ayanot in western Israel near Nes Tsiyona.

Rapho Guillumette

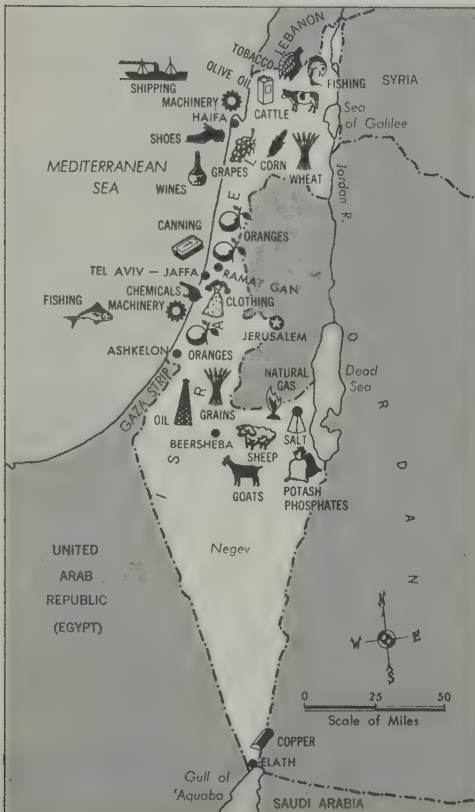
center is located in Tel Aviv and the surrounding area, where textiles and apparel, woodworking and furniture, chemical products, building materials, leather goods, pharmaceuticals, beverages, processed foods, and plastics are produced. Industries in the Haifa region include cement, oil refining, electrical and other machinery, chemicals,

ceramics, glass, tools, and sanitary equipment. Handicrafts and printing are important in the Jerusalem area, while the diamond cutting and polishing industry, a major source of exports, is located in the Natanya (Nathanya, Netanya) district on the coast. Approximately one fourth of the gainfully employed population works in industry and mining. Since the founding of the state, expansion has been particularly important in chemicals, building materials, plastics, rubber products, paper and cardboard products, glass, plywood products, machinery and metals, vehicles, and mining and quarrying. Israel's chief mineral products and average annual output for the period 1959-1961 are as follows: potash, 105,000 tons; bromine, 2,400; phosphate rock, 218,000; copper, 5,600; and petroleum, 129,000.

Agriculture.—Agriculture, which employs about one sixth of the labor force, provides more than three fourths of the nation's food requirements and is also an important source of exports. Both cultivation and marketing are characterized by various forms of collective, cooperative, and private enterprise. The collective settlements (*kibbutzim* or *krutzot*, *moshavim shitufim*) form closely knit social as well as productive units. Increasingly they have been supplemented by organizations of a cooperative type, the most important of which are the workers' cooperative smallholders' settlements (*moshvei ovdim*). There are also ordinary rural villages based on private landownership (*moshavot*). Of the 750 villages of all types in 1961, 450 had been founded after the establishment of the state. The total rural population of about 500,000 occupies approximately 1,000,000 acres of cultivated land. Between 1948 and 1961 the cultivated area more than doubled, and the irrigated area quadrupled, reaching nearly 350,000 acres. Large-scale irrigation developments include the Hule project in upper Galilee, the Kishon project north of Haifa, the two large Yarkon-Negev pipelines, and the giant Jordan-Negev pipeline. Afforestation projects cover about 75,000 acres, of which 65,000 acres were planted after 1948.

The chief field crops are wheat, barley, oats, hay, and pulses. Among other farm products are milk, eggs, vegetables, potatoes, poultry, green fodder, oilseeds, tobacco, and olives. In 1955, Israel harvested its first large cotton crop, and within a few years output supplied the greater part of domestic requirements. Other industrial

Chief cities, industries, products, and resources.



ISRAEL



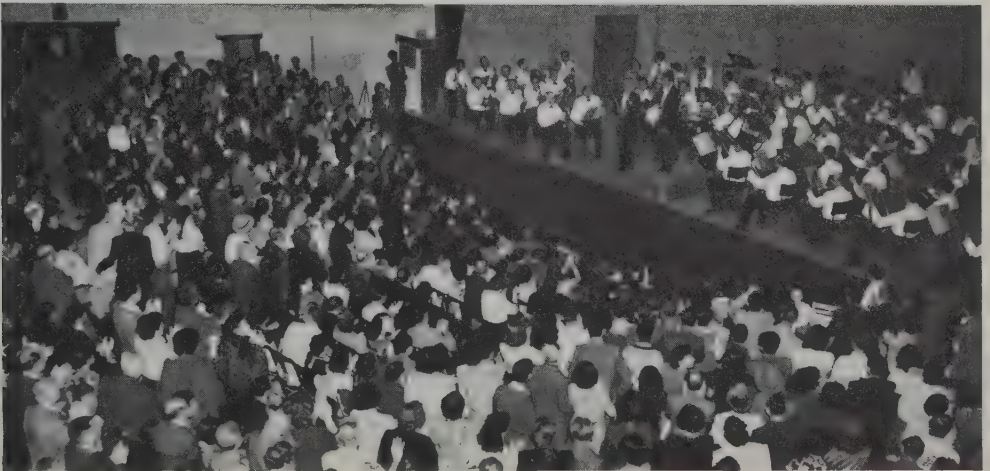
Top: The inauguration of Chaim Weizmann (1874-1952) as the first president of Israel.

Right: Portrait sketching from life in a Jerusalem art class.

Courtesy Israel Office of Information



Bottom: Leonard Bernstein conducts the Israel Philharmonic in a Jerusalem concert. The soloist is Jascha Heifetz.



crops are sugar beets, peanuts, flax, agave, and kenaf. The important citrus crop yields about 10 million cases annually for export and constitutes a major source of foreign exchange. Other fruit crops are bananas, grapes, apples, plums, and figs.

Foreign Trade.—Mass immigration and a high rate of capital construction have inevitably produced an excess of imports over exports. With the gradual growth of export industries, the deficit on the commodity account has tended to diminish steadily in relative terms, though not absolutely. Exports rose in value from \$36.9 million in 1950 to \$279.2 million in 1962, while imports increased from \$298.8 million to \$612.4 million. Hence the deficit rose from \$261.9 million in 1950 to \$333.2 million in 1962; and although the proportion of exports to imports increased from 13.5 percent to 45.6 percent in this period, the trade imbalance still represented a staggering burden. With the gains achieved by Israeli industry, industrial exports likewise rose, both in absolute terms and relative to nonindustrial exports. The country's chief exports are cut and polished diamonds, citrus fruits and citrus byproducts, textiles, eggs and other agricultural products, tires, food products, minerals, machinery and metal products, and electrical appliances. Imports include machinery and vehicles, foodstuffs, industrial raw materials, timber, and chemicals. The United States, the chief market for Israel's diamond exports, and Great Britain, an important buyer of its citrus crop, are the two major trading partners. Other trading partners of importance are countries of the European Economic Community, Turkey, Finland, and Switzerland.

Transportation and Communications.—Since the founding of the state the Mediterranean ports of Haifa and Tel Aviv have been expanded, and the port of Elath has been developed on the Gulf of 'Aqaba. Construction of a second deep-water port supplementing that at Haifa was begun in 1961 at Ashdod, about 20 miles south of Tel Aviv. Following the lifting of an Egyptian blockade, the first large vessel arrived at Elath on March 25, 1957. The merchant marine, which carries about 43 percent of the nation's imports and 31 percent of its exports, comprised 68 vessels aggregating 662,000 deadweight tons at the end of 1961.

The Israeli railroad system, comprising about 417 miles of main and branch lines (1961), connects Jerusalem, Tel Aviv, and Haifa. Main roads maintained by the government totaled 1,900 miles in 1961. Lydda (Lod), the chief airport, is an international Middle East terminus. El Al Israel Airlines, Ltd., operates services to New York and to various world capitals. Jetliner service was introduced in 1961.

Kol Israel, the state-owned radio network, broadcasts from Jerusalem and Tel Aviv in Hebrew, Arabic, and other languages. Educational television was approved by the Knesset in 1963. There are 24 daily newspapers, including 14 in Hebrew.

4. EDUCATION AND CULTURAL LIFE

Educational Facilities.—A law of 1949 provided for free and compulsory education from the age of 5 to the age of 14. Under the State Education Law of 1953, a unified state-controlled elementary school system was established, with provisions for general and religious schools, at the option of the parents. Most schools are co-educational, with eight years' study in elementary

and four in secondary schools. Secondary schooling entails a fee, but there are state subventions of fees, adjusted to the parents' income. The language of instruction is Hebrew except in the Arab schools, where it is Arabic.

The country's educational institutions accommodated approximately 600,000 students in 1961. In addition to the kindergartens, primary schools, and secondary schools, there are evening schools for working youths, schools for the handicapped, vocational and agricultural schools, schools in farm collectives, teacher-training schools, and other specialized institutions. School attendance among the Arab population in 1961 was 95 percent for boys and 50 percent for girls. Higher education is provided at Hebrew University in Jerusalem, one of the finest universities of the Middle East (enrollment, 1960-1961: 6,589); the Technion-Israel Institute of Technology (1,799) in Haifa; Tel Aviv University (825); and Bar-Ilan University (611) at Ramat Gan.

Cultural Facilities.—The continued development of Hebrew as a living tongue suitable for daily speech and modern science, scholarship, and literature is the express aim of the Hebrew Language Academy established by law in 1953. Other institutions that link the cultural life of the Israelis with the rich heritage of the Jewish people are the art museums at Jerusalem, Tel Aviv, and 'Ein Harod and several smaller historical, archaeological, and natural history museums. The Jewish National and University Library in Jerusalem is the country's largest library, with more than 1,000,000 volumes; bookmobiles cater to outlying districts. Numerous literary and technical periodicals appear in several languages.

Israel has several repertory theater companies, the best known of which is Habimah. In addition to the internationally known Israel Philharmonic Orchestra, there are a number of other ensembles, conservatories, and ballet schools.

Scientific Research.—The National Council for Research and Development in the prime minister's office provides advice on national policy and coordinates governmental activities and spending on research and development. Affiliated with it are the Negev Institute for Arid Zone Research at Beersheba, which conducts research in plant and animal biology, water desalination, and the use of the Negev's resources; the National Physical Laboratory, which establishes national standards and conducts research in the utilization of solar energy and other fields of applied physics; and the Fibers and Forest Products Institute, which conducts research on fibers, paper, and leather. The nation's Atomic Energy Commission has been occupied with a survey of the country's radioactive minerals, methods of obtaining uranium from phosphates, and means of producing heavy water. In addition, research is conducted in medicine, geology, and physics at Hebrew University; in applied mathematics, nuclear physics, and other special sciences at the internationally known Weizmann Institute of Science at Rehovot; in industrial processes by the Technion at Haifa; and in other fields by the Israel Institute for Biological Research, the Institute of Agriculture, the Geological Institute, and the Geophysical Institute.

5. GOVERNMENT

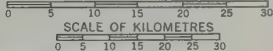
Israel has been a parliamentary democracy since the inception of the state. The literate and politically conscious electorate, though divided on many issues, is almost universally imbued with

ISRAEL and JORDAN

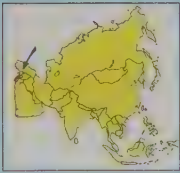
CYLINDRICAL PROJECTION

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SCALE OF MILES



- Capitals of Countries ★
- District and Provincial Capitals ●
- International Boundaries —
- District and Provincial Boundaries ---
- Demilitarized Zone Boundaries ---
- Neutral Zone Boundaries ---
- Railroads —+—



ISRAEL AND JORDAN

ISRAEL

Total Population 2,565,000	
DISTRICTS	
Central, 426,454	B 3
Haifa, 391,380	C 2
Jerusalem, 201,749	B 4
Northern, 363,159	C 2
Southern, 213,283	B, D 5
Tel Aviv, 739,776	B 3

CITIES AND TOWNS

Acre, 28,100	C 2
Aqifim, 1,243	D 2
*Afula, 15,000	C 2
Ahuzzam, 407	B 4
Arko (Acre), 28,100	C 2
*Arrabe, 3,636	C 2
Asdod, 11,700	B 4
Ashdot Ya'aqov, 1,197	D 2
Ashqelon, 28,400	A 4
Atlit, 1,516	B 2
Aviath, 576	C 3
Bat Shalom, 218	B 2
Bat Yam, 39,100	B 3
Beer Ora	D 5
Be'er Tuveya, 602	B 4
Be'erli, 390	A 5
BeerSheva, 51,600	D 4
Beit Guvrin	B 4
Bene Beraq, 51,700	B 3
Bet Dagon, 2,932	B 4
Bet Hagaddi, 566	B 5
Bet Rama, 228	B 5
Bet She'an, 10,900	D 2
Binyamina, 2,950	B 2
Carmiel	C 2
Dafna, 577	D 1
Dalyat al-Karmel, 4,124	B 2
Dan, 498	D 1
Dikma, 12,100	A 4
Dor, 195	B 2
*Ein Harod, 1,372	C 2
El 'Auja	D 5
Elath (Eilat), 7,000	D 5
Elyakim, 568	C 2
Elyashiv, 435	B 3
Even Yehuda, 3,464	B 3
Ga'on, 356	B 4
Gan Yavne, 2,668	B 4
Gat, 430	B 4
Gedera, 4,561	B 4
Gersh, 360	D 2
Gesher Haziv, 238	C 1
Geva'ram, 283	B 4
Gilat, 561	B 5
Ginosar, 473	D 2
*Ivrit Brenner, 1,505	B 4
Gitai Hayayim, 1,380	B 3
Gi'vatayim, 30,932	B 3
Gosh Halav (Jish), 1,498	C 1
Habonim, 189	B 2
Hadar Ramatayim, 6,438	B 3
Hadera, 27,200	B 3
Hertza, 195,400	B 2
Hartuv, 8,200	B 4
Hazerim, 127	B 5
Helez, 466	B 4
Herzeliya, 30,000	B 3
Hodiyah, 400	B 5
Holon, 55,200	B 3
Iksal, 2,156	C 2
Jerusalem (cap.), 181,100	C 4
Jish, 1,498	C 1
Kafar Kanna, 3,549	C 2
Kafar Yasif, 2,975	C 2
Karkur, 2,856	C 3
Kefar Atta, 16,300	C 2
Kefar Blum, 565	D 1
Kefar Gil'adi, 701	D 1
Kefar Ruppim, 306	D 3
Kefar Sava, 19,000	B 3
Kefar Vitkin, 808	B 3
Kefar Yona, 2,372	B 3
Kefar Zekharia, 420	B 4
Kinneret, 909	D 2
Kurnub	C 5
Lod (Lydda), 21,000	B 4
Lodda, 21,000	B 4
Magd'el, 4,815	B 3
Magen, 149	A 5
Mash' Abbe Sade, 238	B 6
Maq'im, 177	B 4
Megiddo	C 2
Me'ona, 317	C 2
Metula, 261	D 1
Migdal, 688	C 2
Mikmoret, 608	B 3
Mishmar Hanegev, 336	B 5
Mivtahim, 398	A 5
Mizpe Ramon, 331	D 3
*City and suburbs	

*City and suburbs. †Population of district.

Moza Ilit, 219	C 4
Mughar, 4,010	C 2
Mueibelle, 459	C 2
Nahariya, 15,900	C 1
Nazareth, 26,400	B 4
Negba, 435	B 4
Nes Zivya, 11,200	B 4
Nesher, 8,450	C 2
Netanya, 46,200	B 3
Neveatim, 436	B 5
Newe Yam, 211	B 2
Nir Am, 331	B 2
Nir Yizhaq, 209	B 4
Nizzanim, 479	B 4
Oron	C 6
Pardes Hanna, 8,200	B 2
Pedyum, 361	B 5
Petah Tiqwa, 58,700	B 3
Pithulim, 2,986	C 2
Qadma, 157	C 2
Qiryat Bialik, 10,400	C 2
Qiryat Gat, 10,111	B 4
Qiryat Haayin, 9,256	B 2
Qiryat Motzkin, 10,300	C 2
Qiryat Shemona, 13,900	C 2
Qiryat Ti'on, 9,518	C 2
Qiryat Yam, 11,600	C 2
Ra'anana, 10,000	B 3
Ramat Gan, 95,800	B 3
Ramat Hasharon, 11,100	B 3
Ramat, 2,986	C 2
Ramla, 23,900	B 4
Rehovot, 30,400	B 4
Re'im, 155	A 5
Revadim, 175	B 4
Revivim, 259	B 5
Rishon Le Ziyon, 30,000	D 2
Rosh Pina, 700	D 2
Ruhama, 497	B 4
Sa'ad, 418	B 5
Safad (Zefat), 11,500	C 2
Sakhnin, 5,500	C 2
Sedona, 12,100	D 2
Sedot Yam, 511	B 1
Shave Ziyon, 269	B 3
Shefar'am, 7,650	C 2
Shafayim, 614	B 3
Shoval, 393	C 2
Taiyiba, 8,100	C 3
Tel Aviv-Jaffa, 394,400	B 3
Tiberias, 22,300	B 2
Tirat Hakarmel, 11,300	B 2
Tirat Zevi, 353	D 3
Ti'on, 9,650	D 2
Tirza, 2,304	C 2
Umm el Fahm, 8,100	C 2
Urim, 203	B 5
Uzza, 487	B 4
Yad Mordekhai, 416	A 1
Yagur, 1,266	C 2
Yotva, 6,504	C 2
Yavne'el, 1,580	C 2
Yehud, 7,000	B 3
Yeroham, 1,574	B 6
Yesodot, 293	B 4
Yeshu Hama'ala, 428	D 1
Yotva, 2,715	C 2
Yotva, 2,715	C 2
Yotva, 2,715	C 2
Zafat, 11,500	C 2
Zikhron Ya'aqov, 4,393	B 2
Zippori, 241	C 2

PHYSICAL FEATURES

Acre (bay)	C 2
*Araba, Wadi (dry river)	D 5
Beer Efe (well)	B 4
Beer Sheva', Wadi (dry river)	B 4
Borot Kidod (well)	C 5
Carmel (cape)	B 2
Carmel (mt.)	C 2
Dead (sea)	C 5
*Ein Gedi (well)	C 5
*Ein Netafim (well)	D 5
Galilee (region)	C 2
Galilee, Sea of (sea)	C 2
Gerar, Wadi (dry river)	B 5
Habesor, Wadi (dry river)	B 5
Hadera (river)	B 4
Hitra (mt.)	B 6
Hayaron, Wadi (dry river)	B 3
Hemar, Wadi (dry river)	C 5
Judaea (region)	B 5
Kishon, Wadi (dry river)	C 2
Kishon, Wadi (dry river)	C 2
*Meiron (mt.)	C 1
Negev (region)	D 5
Paran, Wadi (dry river)	D 5
Qarn (river)	C 1
Ramon (mt.)	D 5
Rubin, Wadi (dry river)	B 4

Shioma (river)	B 4
Tabor (mt.)	C 2
Tiberias (Galilee) (sea)	D 2
Tselim, Wadi (dry river)	C 5
Tsin, Wadi (dry river)	D 5
Yarmuk (river)	D 2

JORDAN

Total Population 1,900,000

DISTRICTS

*Ajlun, 273,976	D 3
Amman, 433,618	D 4
El Balqa, 79,057	D 4
El Karak, 67,211	E 5
Hebron, 119,432	C 5
Jerusa, 344,270	D 4
Ma'an, 46,914	D 5
Nablus, 341,748	C 3

CITIES AND TOWNS

*Ajja, 1,190	C 3
*Ajlun, 5,390	D 3
Amman (cap.), 246,475	D 4
Amman, *280,651	D 4
*Anabta, 4,018	C 2
Anin, 752	C 3
*Anjara, 3,163	C 3
*Anza, 1,011	C 3
*Aqaba, 6,908	D 6
*Aqaba, 1,164	C 3
*Aqaba, 2,875	C 3
Ariha (Jericho), 10,166	C 4
*Arraba, 4,865	C 3
*Arura, 1,337	C 3
*Attil, 4,087	C 3
Bal'ama, 769	E 3
Baqura, 3,042	D 2
Beit Fajjar, 2,162	C 4
Beit Hanina, 3,057	C 4
Beit Jala, 7,966	C 4
Beit Lahm (Bethlehem), 22,453	C 4
Beit Nuba, 1,350	B 4
Beit Sahur, 5,316	C 4
Bethlehem, 22,453	C 4
Bethlehem, *35,735	C 4
Bidda, 1,444	C 4
Bir Zeit, 3,253	C 4
Birzin, 2,055	C 4
Burqa, 3,352	D 3
Damiya, 483	D 3
Dana, 844	E 5
Deir Abu Sa'id, 1,927	D 3
Deir Ballut, 1,087	C 3
Deir Sharaf, 1,241	C 3
Dhahiriya, 4,199	B 5
Duma, 446	C 3
Dura, 3,852	C 3
El 'Al, 492	D 4
El Bira, 14,510	C 4
El Husn, 3,728	D 3
El Karak, 7,422	E 4
El Khalil (Hebron), 37,868	C 4
El Kitta, 967	C 4
El Madwar, 164	E 3
El Mafrq, 9,499	E 3
El Majdal, 259	D 3
El Quweira, 268	E 5
El Yaduda, 251	D 4
Er Rafid, 787	D 2
Er Ramtha, 10,781	E 2
Er Rihya, 555	C 5
Er Rumman, 293	D 3
Er Ruseif, 6,200	E 4
Es Sahab, 2,580	E 4
Es Salt, 16,176	E 5
Es Sukhna, 649	E 3
Esh Shaubak, 14,634	D 5
Et Tafila, 4,506	E 5
Et Tayyiba, 2,606	D 2
Ez Zababida, 1,474	E 3
Ez Zarqa, 36,080	C 3
Falama, 178	C 3
Ghor Dhira', 214	C 5
Ghor Mazra', 1,194	C 5
Ghor Safi, 3,468	E 5
Halhul, 5,387	C 4
Hama, 635	D 2
Harris, 726	C 3
Hawara, 2,342	D 2
Hebron, 37,868	C 4
Hisban, 718	D 4
Ibbin, 1,364	D 3
Idna, 3,568	C 4
Imwas, 1,955	C 4
Irbid, 44,685	D 2
Jaba', 2,507	C 3
Jabir, 135	E 2
Jalama, 784	C 3
Jalun, 626	C 3

Jalud, 290	C 3
Jarash, 3,796	D 3
Jenin, 14,402	C 3
Jericho, 10,166	C 4
Jerusalem (Old City), 60,488	C 4
Jifna, 758	C 4
Ma'in, 1,271	D 4
Kitim, 1,026	D 3
Kufrinja, 3,922	D 3
Ma'ad, 125	D 2
Ma'an, 6,643	E 5
Ma'daba, 11,224	C 4
Manja, 353	D 4
Nablus (Nabulus), 45,768	C 3
Nahhalin, 1,015	C 4
Na'ur, 2,382	D 4
Niliin, 1,539	C 4
Nimrin (Shunat Nimrin), 109	D 4
Nitil, 348	D 4
Qabalan, 1,867	C 3
Qabatiya, 5,917	C 3
Qafin, 2,457	C 3
Qalqiliya, 11,401	C 3
Qibya, 1,635	C 4
Qumeim, 955	D 2
Rafidiya, 923	D 2
Ramallah, 14,759	C 4
Rammun, 1,186	C 3
Rantis, 1,539	C 4
Ra's en Naqb, 225	E 5
Safut, 421	D 3
Salfit, 3,393	C 3
Samar, 716	D 2
Sarh, 3,390	C 3
Shufat, 2,541	C 4
Shunat Nimrin (Nimrin), 109	D 4
Shuweika, 3,099	C 3
Silat Dhahr, 3,566	C 3
Sinjil, 1,778	C 3
Siris, 1,207	C 4
Subeih, 514	C 4
Surf, 3,259	D 3
Suwayh, 3,103	C 5
Suwayh, 3,457	C 5
Suweima, 315	D 4
Tammun, 2,593	C 4
Tarqumiya, 2,651	C 4
Tubas, 5,709	C 3
Tulkarm, 20,690	C 3
Tur, 4,289	C 4
Um Jauza, 582	D 3
Wadi es Sir, 4,455	D 3
Wadi Musa, 1,554	E 5
Waqas, 2,321	C 3
Ya'bad, 4,709	C 3
Yabrud, 349	C 4
Yamun, 4,173	C 3
Yatta, 6,326	C 5
Zubaba, 683	C 5
Zuweiza, 126	D 4

PHYSICAL FEATURES

*Ajlun (mt. range)	D 3
*Aqaba (gulf)	D 6
*Araba, Wadi (dry river)	D 5
Dead (sea)	C 4
Ebal (mt.)	C 3
El Ghor (reg.)	C 5
El Lisan (pen.)	C 5
Hasa, Wadi (dry river)	E 5
Hebron (mt.)	C 4
Jordan (river)	D 3
Judaea (region)	C 4
Khribet Qumran (site)	D 4
Kufrinja, Wadi (dry river)	D 3
Mashash, Wadi (dry river)	C 4
Nebo (mt.)	D 4
Petra (ruins)	D 5
Ramm, Jebel (mt.)	E 5
Samaria (region)	C 3
Shallala, Wadi (dry river)	D 2
Shu'eb, Wadi (dry river)	D 4
Tell 'Asur (mt.)	C 4
Yabis, Wadi (dry river)	D 3
Zarqa' (river)	D 3

GAZA STRIP

Total Population 430,000

CITIES AND TOWNS

*Abasan	A 5
Bani Suheila	A 5
Beit Hanina	A 4
Deir el Balah	A 5
Gaza, 34,170	A 5
Jabaliya	A 4
Khan Yunis, 11,220	A 5
Rafah	A 5

ISRAEL: Total pop.—1965 off. est.; cities over 100,000—1963 off. est.; other pops—1961 final census. JORDAN: Total pop.—1964 U.N. est.; other pops—1961 final census.

the Zionist ideal. This has produced relative stability in leadership, which other governments of the ministerial type have often lacked. The leading political party indeed has had to depend on allied groups for a parliamentary majority, but the differences among the major parties have not been so fundamental or so bitter as to make coalition rule unobtainable. The principal domestic issues have been the degree of government control in the economy and the role of religious orthodoxy and tradition in secular matters. In foreign affairs there has been considerable opposition by leftist parties to close ties with the Western powers, and rightists have demanded greater militancy against the Arab states that surround Israel.

Governmental Structure and Political Parties.—Israel has no written constitution. The Transition Law adopted by the Knesset (Assembly) in 1949 delineated certain organic functions, such as the formation and powers of the legislative and executive branches. In 1950 the Knesset voted to legislate separately on constitutional matters, these acts eventually to comprise the nation's fundamental code of laws. The president of Israel, whose office is largely titular, is elected by the Knesset for a five-year term.

The Knesset, a unicameral, 120-member body, is elected for a four-year term by secret ballot and universal suffrage through proportional representation. The franchise is held by men and women (non-Jews as well as Jews) over 18 years of age. Voters cast their ballots for party lists rather than for individual candidates, and seats are allotted in proportion to the number of votes obtained by each list. The cabinet is responsible to the Knesset and holds office only so long as it retains the confidence of that body. The chief political parties are the Mapai (Israel Labor Party), a Zionist-Socialist party which has provided the nation's leadership since the founding of the state; the Liberal Party (formed in 1961 by a merger of the General Zionist and Progressive parties), which stresses private enterprise in the economy; the Mapam (United Workers Party) and the Achdut Ha'avoda (Unity of Labor), more leftist than the Mapai; and the ultranationalist Herut (Freedom). Smaller groups include the parties of the religious bloc and the Israel Communist Party.

Defense.—The Israel Defense Forces, well equipped and of high morale, are regarded as among the crack forces of the Middle East. A General Staff commands all three forces—land, sea, and air. Under the Defense Service Law passed in 1949 and amended in 1950 and 1952, men and unmarried women are generally drafted for military service upon reaching the age of 18. Men of the age group 18–26 serve for 30 months; of the age group 27–29, for two years. Unmarried women of the age group 18–26 also serve for two years. Men up to the age of 49 and childless women up to the age of 34 are regularly called up for service in the reserves. Army service includes a period of agricultural training, and the defense forces play an important role in education, particularly as a school for the learning of Hebrew.

Public Health and Welfare.—About two thirds of the population receive medical services through Kupat Holim, the medical branch of Histadrut, Israel's many-sided labor organization. Also important are the public hospitals and other facilities operated by the Ministry of Health; the Hadassah Medical Organization, sponsored by Hadassah, the women's Zionist organization of

America; and Malben (Institute for the Care of Handicapped Immigrants), sponsored by the American Joint Distribution Committee. Israel has the greatest number of physicians in proportion to population of any country in the world.

The National Insurance Law of 1953 provided for a comprehensive program of social insurance to come into being in three stages. The first stage (effective in 1954) comprised old-age and survivors' insurance for the entire population, maternity insurance and infant benefits, industrial accident insurance, and family allowances for each child under 14 after the third.

Public Finance.—The Israeli pound (₪) was established as the national currency in 1948, with a value of U.S.\$4.03 at the official rate of exchange. Under the succeeding systems of multiple exchange rates, however, the effective rates varied according to the nature of the transaction, while devaluations had reduced the principal rate to \$0.556 by 1953. On Feb. 9, 1962, a uniform exchange rate of ₪3 to the dollar (or ₪1 = \$0.333) was introduced.

The draft budget for the fiscal year April 1, 1963–March 31, 1964 totaled ₪2,790 million, including ₪560 million for development. Regular revenue is derived chiefly from income taxes, excises, and customs duties. Funds for development have come largely from government bond sales, foreign contributions to the Jewish Agency by fund-raising institutions such as the United Jewish Appeal, and counterpart funds of United States grants-in-aid. An important additional source was made available by a reparations agreement signed by Israel and the Federal Republic of Germany on Sept. 10, 1952 (ratified in 1953), whereby the Bonn government agreed to pay to Israel \$715 million, chiefly in German goods, over a period not exceeding 14 years.

6. HISTORY²

Internal Affairs.—Political Developments.

—Following the proclamation of the state on May 14, 1948, by the Jewish National Council, David Ben-Gurion, labor spokesman and political leader, was chosen prime minister of a provisional government, and Chaim Weizmann, leader of the world Zionist movement, was named president. The first general election was held on Jan. 25, 1949. The Mapai, a democratic labor party led by Ben-Gurion, emerged as the leading party, obtaining 46 of the 120 seats in the Knesset. The Knesset elected Dr. Weizmann president of Israel on Feb. 16, 1949, and on March 10 Ben-Gurion formed a coalition cabinet of the Mapai and most of the religious parties.

Following a succession of cabinet crises arising from economic difficulties, the second general election took place on July 30, 1951. The Mapai retained its leading position, obtaining 45 seats, but the General Zionists gained 13 seats, for a total of 20. Ben-Gurion continued as prime minister until Dec. 7, 1953, when he retired to a collective farm. On Jan. 26, 1954, Moshe Sharett, foreign minister under Ben-Gurion, headed a new coalition consisting mainly of the Mapai and the General Zionists. Meanwhile, President Weizmann had died in office on Nov. 9, 1952, and Itzhak Ben-Zvi (1884–1963), a noted Middle East scholar, succeeded as the second president on Dec.

²For an account of the events leading up to the proclamation of the state and of the warfare between Israel and the Arab states in 1948 and early 1949, see JEWISH HISTORY AND SOCIETY—16. *Zionism* and 17. *Jews in Modern Palestine*.

ISRAEL



Left: Israeli workers in the diamond-cutting industry.

Center: The Bialik School, one of the many educational institutions in Israel which receives American financial support.

Bottom: Nahalal, northern Israel, six miles west of Nazareth. This modern village, founded in 1921, on reclaimed land, was the first smallholders' cooperative settlement in Palestine. Residents live in a circular formation and tend the land strips radiating from their circle frontages.

(Left and center) Palestine Foundation Fund;
(bottom) Israel Office of Information



10, 1952. Ben-Zvi was reelected in 1957 and 1962. On May 21, 1963, Schneor Zalman Shazar was elected to succeed him as president.

Elections to the third Knesset took place on July 26, 1955, amid mounting tension between Israel and the surrounding Arab states. The Mapai suffered its first sizable loss, obtaining 40 seats. The militant Herut received 15 seats; for a gain of 7, and displaced the General Zionists as the second largest party. Ben-Gurion resumed the premiership on Nov. 3, 1955, heading a coalition of the Mapai, leftist Socialist, and smaller parties. In the fourth general election, which took place on Nov. 3, 1959, the Mapai recouped its loss, obtaining 47 seats, and the Herut won 17 seats. On December 17, Ben-Gurion formed a new Mapai-led coalition cabinet.

On Dec. 25, 1960, Pinhas Lavon, a former defense minister who had resigned under pressure in 1955, was exonerated by a cabinet committee of responsibility for a secret security venture of 1954 that had had disastrous results. The affair produced a cabinet impasse when Ben-Gurion refused to accept Lavon's exoneration and resigned on Jan. 31, 1961. With Ben-Gurion heading a caretaker cabinet, the fifth general election took place on August 15. The Mapai obtained 42 seats, for a loss of 5. The newly formed Liberal Party, headed by Nahum Goldmann, president of the World Zionist Organization, received 17 seats. Ben-Gurion again headed a new Mapai-led coalition government on November 2. He continued in office until June 6, 1963, when he resigned; on June 19, Levi Eshkol, minister of finance and a member of Mapai, succeeded to the premiership.

Economic and Social Problems.—On assuming office in 1949, Ben-Gurion had initiated an ambitious program to expand the economy and absorb the influx of immigrants. This program suffered a setback in the latter half of 1950, when the pressure of the expanding population and the rising cost of imports caused a breakdown of the price control system and a shortage of consumer goods. In February 1952, Ben-Gurion outlined a new economic policy, designed to encourage private enterprise, increase efficiency of production by competitive pricing, and curtail nonessential imports. Nevertheless, price levels continued to rise, and unemployment reached serious proportions in 1953 because of shortages of raw materials and the closing down of noncompetitive firms. Meanwhile, however, the falling off of immigration beginning in late 1951 had begun to ease pressure on prices, and gradually the new arrivals became absorbed in productive work. New and expanded enterprises began to contribute to output. By 1955 unemployment had been reduced, and output expanded by about one third over 1952.

In the next few years foreign and domestic investment mounted steadily. Irrigation projects and other long-term undertakings in agriculture, industry, and transport came to fruition. By 1958, the year of Israel's tenth anniversary as an independent state, approximately 900,000 immigrants had been absorbed, the area under cultivation had more than doubled, and over-all industrial and agricultural output had risen more than threefold. Economic conditions continued to improve in the early 1960's. Rationing had ended in 1959, the unemployment problem had been liquidated by 1962, and the general standard of living had risen appreciably since the years of austerity in the previous decade. One of the most difficult

economic problems that remained to be solved was that of the imbalance of trade. In 1962 the government introduced a far-reaching four-year plan to reduce the excess of imports, intensify development of the Negev and Galilee regions, and maintain a 10 percent average annual increase in the gross national product. By a currency devaluation on February 9, the government had sought to reduce the trade deficit by improving the competitive position of Israeli producers in world markets, and the four-year plan aimed to raise the efficiency of production, curb increases in domestic consumption so as to reduce imports, stabilize price levels, and encourage domestic saving and investment.

Among the problems of the new Jewish state has been the role of Jewish tradition in a modern community largely secular in outlook. Controversy on the issue of Jewish identity arose in 1958, when the government decreed that the designation "Jewish" should be entered on the registration cards of persons who declared themselves Jewish. Religious leaders objected that the government was seeking to usurp the right of defining who is or is not a Jew, and that this should remain within the province of the religious authorities, who have held, in accordance with tradition, that a Jew can only be someone who is born of a Jewish mother and who does not belong to another religion, or one who has been converted to Judaism in accordance with religious law. On Dec. 6, 1962, Israel's Supreme Court ruled that a Jew who becomes converted to another religion is not regarded as a Jew under the Law of Return (enacted in 1950), which recognizes the right of every Jew to settle in Israel.

Adolf Eichmann, who played a leading role in the Nazi extermination of millions of European Jews during World War II, was seized in Argentina and abducted to Israel by Israeli agents in May 1960. Eichmann was tried in Jerusalem on April 11–Aug. 14, 1961, before a tribunal of three judges, and was found guilty of crimes against the Jewish people, war crimes, and other crimes. The trial, which commanded world attention and evoked pictures of the hideous Nazi atrocities, resulted in a death sentence for the defendant, who was executed in Ramle prison on May 31, 1962.

Foreign Relations.—Israel withstood the first military threat to its independence by staving off the Arab armies in the war of 1948–1949 (see ISRAELI-ARAB WAR). Through the mediation of the United Nations, armistice agreements were signed in 1949 with Egypt (February 24), Lebanon (March 23), Jordan (April 3), and Syria (July 20). In the years that followed, however, there was neither peace nor war. The Arab states refused to accept the truce boundaries as permanent or to recognize Israel as a sovereign state. Arab leaders held that peace treaties were possible only if Israel would readmit the approximately 900,000 Arab refugees who had fled or were driven from their homes during the war of 1948–1949, and if Israel would relinquish all territory not included in the United Nations partition resolution of 1947. Israeli leaders declared that the actions of the Arab states themselves (in the invasions of 1948) had nullified the United Nations partition resolution, and that the conditions for peace put forward by the Arab leaders would mean the death of Israel as a nation. In the consequent impasse over a permanent settlement, Arab governments mounted economic boycotts

against Israel, Israeli-bound shipping was blocked by Egypt in the Suez Canal and the Strait of Tiran (at the entrance of the Gulf of 'Aqaba), and Arab propagandists spread hatred of Israel.

A major source of Israeli-Arab tension was the continuing border violence in the form of Arab raids on Israeli settlements and Israeli retaliatory attacks. The chief areas of conflict were the northeastern border with Syria, the Sea of Galilee, the eastern border with Jordan (including divided Jerusalem), and the outlying Negev areas facing the Egyptian-held Gaza Strip. Although the United Nations truce staff was able to halt sustained actions by the armed forces of the respective sides, it proved almost powerless to prevent incessant forays by small Arab marauder bands. According to Israel, in the period 1951-1955 Arab attackers exacted a toll of almost 900 Israeli dead and wounded.

As border violence mounted in intensity, Israel watched apprehensively while Egyptian military power was increased by Communist-bloc deliveries (beginning in late 1955) of jet planes, tanks, and other modern weapons, and as Egyptian President Gamal Abdel Nasser took steps in 1956 to organize an anti-Israeli military alliance among the Arab states. On Oct. 29, 1956, Israeli Army columns struck across the southern border at Egyptian positions in the Sinai Peninsula, where Egypt had staged many of the *fedayeen* (commando) raids against Negev settlements. In a few sharp battles, chiefly at El Arish (Al 'Arish), Abu 'Aweigila, and Rafa (October 30-November 1), the larger and better-equipped Egyptian forces were routed, and the Israelis gained control of the Sinai area and the Gaza Strip. A United Nations-sponsored cease-fire came into effect on November 6, and Israeli forces soon proceeded to withdraw from Egyptian territory. Israel completed its withdrawal on March 8, 1957, with the evacuation of the Gaza Strip and the Sharm el Sheikh section of southern Sinai. Units of the United Nations Emergency Force took over Sharm el Sheikh and were stationed along the Gaza frontier to prevent border incidents.

In the years immediately following the Sinai campaign, border violence diminished, and Israeli ships passed unmolested through the Strait of Tiran. With the growing power of Nasser, however, prospects of an Arab-Israeli peace seemed as distant as ever, and the Israeli government continued to stress vigilance and to seek arms aid from the West. Nasser revived a long-standing issue regarding Israel's use of the Suez Canal in 1959, when he began to subject to cargo seizure and other forms of harassment non-Israeli ships carrying nonmilitary cargoes to and from Israel by way of the canal. In 1960 and 1961, Ben-Gurion visited Washington, London, and Paris, conferring with the heads of government in an effort to obtain big-power backing for a Middle East settlement and an end to the arms race in the region.

See also JERUSALEM; MIDDLE EAST; PALESTINE.

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ISRAEL, Tribes of. Traditionally, the 12 Hebrew tribes were the descendants of the 12 sons of Jacob. The names of these sons—(by Leah) Reuben, Simeon, Levi, Judah, Issachar, Zebulun; (by Rachel) Joseph, Benjamin; (by Bilhah) Dan, Naphtali; (by Zilpah) Gad, Asher—are found, for example, in Genesis 35:22-26, and the list of their offspring, the Hebrew forefathers, is given in Genesis 46:8-27. The allotment of Canaan, after its conquest by Joshua (c. 1250-1200 B.C.), is described in Joshua 13-19; the account is traditional and somewhat idealized.

The conquest was not a sudden irruption of nomads from the desert, but a slow and steady infiltration, following an initial invasion, into the fertile valleys and open country, and leading finally to the capture of the Canaanite cities. The narratives of the Old Testament tell us nothing of the conquest of central Palestine, where the two small "Joseph" tribes, Ephraim and Manasseh, were found later; presumably they had been settled there from an early time, possibly even before the conquest under Joshua.

Entering the land at a point just north of the Dead Sea, the Hebrew advance was blocked by the old Canaanite stronghold of Jericho. Its capture is the theme of the thrilling story in Joshua 6. The adjacent territory later was allotted to the tribe of Benjamin, and that which lay to the west of this, toward the Mediterranean Sea, belonged to Dan; later on, under Philistine pressure, this tribe moved to the far northern end of Palestine. Everything south of this central belt belonged to Judah and Simeon. North of the tribe of Manasseh lay the regions of Asher, Zebulun, Naphtali, and Issachar—territory known after the Babylonian exile (perhaps from 400 B.C.) as Galilee. On the east side of the Jordan River, in addition to the "half tribe" of Manasseh, lay the territories of Gad and Reuben. The characteristics, and to some extent the location, of the tribes are given in the ancient ballad in Genesis 49, *The Blessing of Jacob*. Only Levi was allotted no tribal territory; as the priestly tribe, it was given cities scattered among the 11 others (Joshua 21).

Following the death of King Solomon in 922 B.C., the 10 northern tribes revolted and formed a separate kingdom, the Kingdom of Israel, leaving the tribes of Judah and Benjamin as the Kingdom of Judah, a landlocked realm in the southern highlands. When Israel was conquered by the Assyrians in 721 B.C., the leaders of the people and the well-to-do were led into exile (Sargon II recorded their number as 27,290); in their place were settled eastern peoples from Elam, Babylonia, and Syria. When Judah fell before Nebuchadnezzar II in 597 B.C., and again, after an attempted revolt, in 587, the Judeans were decimated; only the poor were left behind to till the soil and eke out a miserable existence. The northern exiles were never heard from again; they became the Ten Lost Tribes of much later speculation and legend, some identifying them with the Tatars, or the Chinese, or even the American Indians. The truth is that they were probably completely absorbed by the people among whom they were scattered—less than 30,000 persons would soon melt into the vast population of the East. After the Babylonian exile, when a fresh begin-

ning was made in Judah (Judea), the tribal divisions were never again of territorial significance, but only of genealogical interest.

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ISRAEL BEN ELIEZER. See BAAL
SHEM-TOB or BAAL SHEM-TOV.

ISRAELI-ARAB WAR, a conflict fought between the new state of Israel and its Arab neighbors in 1948-1949. The basic causes of the war were (1) the Jewish resolve to create a Jewish state in Palestine where European survivors of the Nazi massacres could find a new life; (2) the Arab resolve to resist what Arabs saw as a foreign invasion of a Arab homeland; and (3) the withdrawal of the British from Palestine, leaving the Jews and the Arabs to fight it out. Emotional tides on both sides ran deep and strong. The Jewish cause was stoutly supported by the American and European Jewish communities, while the Arab cause was championed by all the Arab nations of the Middle East.

Preliminary Operations.—Sporadic fighting, partly of a guerrilla nature, began shortly after Nov. 29, 1947, when the United Nations General Assembly passed a resolution providing for the partition of Palestine into an Arab and a Jewish state. The Arab forces consisted of volunteers from Syria and Iraq, composing the Army of Arab Liberation, and of Palestinian guerrillas under the Arab Higher Committee. The military forces of the Jewish community had been built up clandestinely over a considerable period under the name of Haganah (defense force). They included a mobile striking force, called Palmach (spearhead), of about 3,000 soldiers; field troops, distributed territorially in six brigades, numbering about 12,000 or 15,000; and local defense forces, comprising the remaining able-bodied Jewish population for whom any kind of weapons could be provided, totaling about 32,000. Armament was of a wide variety; there were approximately 10,000 rifles, fewer than 1,000 machine guns and automatic weapons of all kinds, several hundred mortars, virtually no artillery, no tanks, and no military aircraft. Organization, however, was excellent; military training, directed largely by Jewish officers who had served with the British Army in World War II, attained a high level of efficiency, while the spirit and determination of the Haganah left nothing to be desired.

The most serious problem for the Haganah was the supply of the 100,000 Jewish inhabitants of Jerusalem, which was surrounded by Arab-held territory. Very heavy fighting attended attempts (usually successful) to push supply convoys through to Jerusalem, but the road rarely remained open for more than two or three days at a time. In April 1948, the Army of Arab Liberation was decisively defeated at Mishmar ha Emeq (Mishmar Haemek), followed by the fall of Tiberias (April 18) and Safad (Safed; May 10) and by the surrender of Jaffa (May 13). The important port city of Haifa was taken over by the Israelis during the last week of April.

Invasion by the Arab States.—The British mandate ended on May 14, 1948, concurrently with

the declaration of the independence of the state of Israel. On the following day, the armies of Egypt, Transjordan, Iraq, Syria, and Lebanon entered the struggle. The Syrians gained initial successes in the northeast, but their net accomplishment for the entire war consisted in holding a bridgehead on the west bank of the Jordan River. In the center, the Arab Legion of Transjordan—by far the most effective of the Arab invading armies—quickly took possession of the Old City of Jerusalem (May 18) and advanced to Latrun, on the main road between Jerusalem and Tel Aviv. In the south, the Egyptian Army advanced into the Negev, occupied Gaza (May 16) and Beersheba (May 20), and besieged a number of fortified Jewish settlements with little success. Iraq sent a modest force, which took over Arab-inhabited territory north of Jerusalem. Egyptian and Syrian aircraft carried out sporadic raids that accomplished little.

The Israeli forces were at first occupied chiefly with holding their own, pushing through a new road to connect Jerusalem with the coast, and—with the ending of the British naval blockade—importing with desperate haste weapons of all sorts and from many diverse sources. Effective June 11, the United Nations succeeded in imposing a four-week truce, a period which the Israelis used for reorganization and training.

Israeli Offensives.—Fighting was resumed on July 9, after both sides had rejected the peace proposals of the United Nations mediator, Count Folke Bernadotte (q.v.). A major Israeli offensive, involving three brigades and parts of two others, was launched on the central front. It quickly overran the Arab Legion's forward positions at Ramle and Lydda (Lod), captured the important Lydda Airport, regrouped, and was preparing for a new assault on Latrun when a second truce came into force on July 18. In the north, the Israelis cleared the entire belt of southern Galilee from Haifa to the Sea of Galilee, and captured Nazareth (July 18). This was a remarkable accomplishment for a new army. It gave the Israelis possession of the most important communications centers of Palestine, and seemed to have convinced King Abdullah of Transjordan that he should not take further military risks. For the remainder of the war the Arab Legion fought on the defensive.

The Egyptian Army in the south became the focus of Israeli concern. In a brilliant series of offensive operations (October 15-22; December 23-January 7), the Israelis pinned the Egyptian forces against the Mediterranean Sea, cut them off from their main advance base at El Arish (Al 'Arish), and was faced with the choice of surrender or destruction when, on Jan. 7, 1949, the Egyptian government declared to Dr. Ralph J. Bunche (q.v.), who had succeeded Count Bernadotte as United Nations mediator, its readiness to negotiate an armistice. Armistice agreements were signed with Egypt on February 24, Lebanon on March 23, Transjordan (later Jordan) on April 3, and Syria on July 20. No armistice, however, was concluded between Israel and Iraq or Saudi Arabia.

Results of the War.—Victorious against all the invading armies, Israel was able to insist on armistice terms that left the new state in possession of considerably larger areas of Palestine than had been allotted to it by the United Nations partition resolution. Among these areas were western Galilee, the Jaffa enclave, and an expanded corridor to the New City of Jerusalem, together with the New City itself. From the half-armed

embryo that began the war, the Israeli Army had become composed of 12 strong infantry brigades, supported by tanks and artillery, as well as by an air force and navy with reasonably modern if somewhat diverse armament. Superior leadership and organization were among the ingredients of victory, but at bottom Israel's success must be attributed to the remarkable spirit of its soldiers, who fought with disciplined dash, devotion, and self-sacrifice, which the Arabs—many of whom fought bravely enough—could no more withstand than they could develop the organizational means to coordinate and unify their efforts.

For subsequent relations between Israel and its Arab neighbors, see ISRAEL—6. *History* (Foreign Relations); see also PALESTINE.

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ISRAELITES, iz'ri-él-it-z, an alternative rendering in English of the Hebrew term *Bene Yisrael*, whose literal translation is "sons of Israel" or "children of Israel." The Israelites comprised 12 tribes, each of which traced its ancestry to one of the 12 sons of Jacob, who was also called Israel (Genesis 32:28). For the entire period of slavery in Egypt, wandering in the desert of Sinai, the conquest of Canaan, the fighting under the Judges, and the establishment of a united kingdom under Saul, David, and Solomon, the terms "Israelites" and "Hebrews" can be used interchangeably. After the death of Solomon, however, the kingdom was split into two: Israel, the northern kingdom, whose inhabitants were called sons of Israel, house of Israel, or Israelites; and Judah, the southern kingdom, whose people were called sons of Judah, men of Judah, or Judaeans (from which the English term "Jew" is derived). When the Kingdom of Israel was conquered by Assyria in 721 B.C., its people, many of whom were led into captivity, ceased to exist as an ethnic entity. The term "Israelites" can therefore be applied to all the Hebrews up to the death of Solomon, and thereafter to the inhabitants of the Kingdom of Israel until the Assyrian captivity, following which the historical survivors of the 12 tribes should be referred to as Judaeans or Jews.

See also ISRAEL, TRIBES OF; BIBLE—6. *Old Testament History, Including Archaeology and Chronology*; HEBREWS; JEWISH HISTORY AND SOCIETY.

RAPHAEL PATAI.

ISRAËLS, iz'ra-ëls, Jozef, Dutch painter and etcher: b. Groningen, Netherlands, Jan. 27, 1824; d. The Hague, Aug. 12, 1911. He studied under such diverse masters as Ary Scheffer and Paul Delaroche. Until 1857 he worked insignificantly as a concocter of historical pastiche. Turning to the lives of humble people, he attracted the notice, some years later, of Théophile Gautier, a shrewd critic, who gave him unstinted praise. Israëls has been called an imitator of Jean François Millet, but his narrative gift, though less dramatic than Millet's, is perhaps more consistently clear. Moreover, until his appearance, Dutch art had been smothered by a routine respect for the past. Primarily a genre painter, Israëls nevertheless in-

spired a whole school of gifted landscape artists, among them Anton Mauve.

WALLACE BROCKWAY.

ISSACHAR, is'â-kâr, in Biblical history, the ninth son of Jacob and the fifth by Leah, and the eponym of one of the tribes of Israel (see ISRAEL, TRIBES OF). Tola, a minor judge (Judges 10:1), and Baasha, a king of Israel (I Kings 15:27), were of the tribe of Issachar.

ISSUE, ish'ü, in law, the descendants of a common ancestor, or in pleading, a point affirmed by one party in a suit and denied by the other. In the latter sense an *actual issue* is one formed in an action regularly brought to try a question of right; a *collateral issue* is one formed in a matter only indirectly in the line of the pleading; a *feigned issue* is one formed in a fictitious action, under the authority of a court, to try a question of fact before a jury; a *formal issue* is one formed according to the rules required by law; a *general issue* denies the whole declaration in direct terms; an *immaterial issue* is formed on some nonessential matter that will not determine the merits of the cause; an *informal issue* arises when a material allegation is improperly traversed; a *material issue* determines the merits of the cause when decided; a *special issue* is a single point selected by the defendant on which he rests his whole cause; and a *common issue* is one formed on the plea of *non est factum* to an action of covenant broken.

ISSUS, is'üs, ancient town, Asia Minor, in the Province of Cilicia, situated five miles northwest of modern Dörtöyl, Turkey, on the Gulf of İskenderun, in a narrow coastal plain to the south of passes through the Taurus Mountains. Apart from its importance to ancient geographers as the most easterly point of the Mediterranean Sea in reckoning distances westward, Issus was the scene of two ancient battles.

(1) In 333 B.C., on his eastward march of conquest, Alexander the Great, with probably 35,000 troops, routed Darius III, king of Persia, who had more than 100,000 soldiers. The Battle of Issus ended ancient Asian power in the Mediterranean area.

(2) In 194 A.D., the Roman emperor Lucius Septimius Severus defeated his rival Gaius Pescennius Niger Justus and thus secured his throne. Some 20,000 of Pescennius Niger's soldiers are said to have fallen on the field.

P. R. COLEMAN-NORTON.

ISSY-LES-MOULINEAUX, ê-sê'lâ-môô-lê-nô, town, France, situated in the Department of the Seine, 4 miles southwest of the Cathedral of Notre-Dame, Paris. An industrial suburb, it produces aircraft, steel pipe, electrical equipment, cigarettes, and chemical pharmaceutical products. It is a port on the Seine River and also serves as a heliport for Paris. Pop. (1962) commune, 52,335; town, 51,440.

ISSYK-KUL, is'ik-kûl', lake, USSR, situated in the Kirghiz Soviet Socialist Republic between the Kungei Ala-Tau range to the north and the Terskei Ala-Tau range to the south. It has an area of 2,395 square miles. Its shore is a tourist region dotted with health resorts. Grain is grown in the basin of the lake, and there are fisheries at Rybachye at its western end.

ISTANBUL, *ış-tām-bōōl'*; Turk. *ê-stām-bōōl'*, Turkey (corrupted from Gr. *eis tēn polin*, "to the city"); usual European form, STAMBOUL; formerly CONSTANTINOPLE (q.v.); anciently BYZANTIUM (q.v.). Principal city of the Republic of Turkey and capital of the vilayet (province) of Istanbul, it was previously capital of the Ottoman empire. The Ottoman Turkish names were Qostantiniyeh (city of Constantine) and Dersaadet (Abode of Felicity); the present name, informally used for more than a century, was officially adopted in 1930. The population (census of 1945) of the city proper is 860,558, and of the vilayet (provisional 1950), 1,179,666. The city, partly in Asia and partly in Europe, is built around the exit of the Bosphorus into the Marmara (Marmora) Sea; latitude 41° 0' 16" N., longitude 28° 59' 14" E. The European portion is deeply indented by the Golden Horn (Turk. *Haliç**; Gr. *Keraton*), an inlet extending inland from the southern terminus of the Bosphorus for some six miles, curving clockwise to the northwest and forming a remarkably secure and commodious harbor. On the shore of the Bosphorus, north of the Golden Horn's entrance, are also deepwater docks, where the largest vessels can be berthed.

Istanbul comprises three principal divisions: (1) old Istanbul; (2) Galata-Beyoğlu; and (3) the quarters on the Asiatic shore. Each of these divisions is subdivided into numerous quarters, each with its distinctive name and many with distinctive populations, some largely Turkish, others largely Greek or Armenian or Jewish. In these, Istanbul, in contrast to the homogeneous nature of the rest of modern Turkey's population, continues to represent the heterogeneous population formerly characteristic of the Ottoman Empire, of which it was the capital until 1923.

Old Istanbul.—On the European shore between the Golden Horn and the Marmara lies Istanbul proper, in the limited sense of the name, the Turkish city converted after 1453 from the Greek Constantinople into which Constantine the Great had transformed in 330 the Roman-controlled Greek city-state of Byzantium. This is the area which in ancient and medieval times was surrounded by the walls whose famous remains—after 26 sieges and 44 earthquakes—are one of modern Istanbul's principal sights. The sea walls, which extended along the European coast of the Marmara from the fortress of Yedi Kule (Seven Towers, Byzantine Golden Gate) northeastward to Sarayburnu (Palace Point, Seraglio Point) and thence northwestward along the southern shore of the Golden Horn to Eyüp, are largely destroyed; but the land walls (Eyüp to Yedi Kule), which formed the third side of the triangle, are in a remarkable state of preservation.

Galata-Beyoğlu.—The regions on the European shores northeast of the Golden Horn form the second main division of the city. They include Galata, the quarter immediately skirting the shore, and above and behind it Beyoğlu (Gr. Pera) as well as many other built-up quarters along and above the Golden Horn and the Bosphorus. Continuously from Byzantine times Galata-Beyoğlu have been cosmopolitan, polygot centers and have set the nonnational Levantine tone which travelers often wrongly regard as characteristic of the entire city. In fact, old Istanbul, the city's major division, is largely

Turkish and was largely Greek until 1453. Cosmopolitan Galata-Beyoğlu include the most modern and westernized parts of the city. They contain the principal stores and hotels, and they form the commercial center of the entire city as well as the winter residential center of the modern city.

Asiatic Shore.—The third major division of modern Istanbul is the metropolitan area on the Asiatic shore, across from the mouth of the Golden Horn, and principally comprising the regions of Üsküdar (Scutari), Haydarpaşa (Haydar Pasha), and Kadıköy (Chalcedon).

Other Areas.—In addition to the three major areas there are many villages and towns, some quite sizable, which stretch in a virtually unbroken series along both shores of the Bosphorus northward almost to the Black Sea, and also the increasingly important residential and industrial areas along the Marmara's European shore westward from Yedi Kule and along its Asiatic shore eastward from Kadıköy. Finally, opposite this Asiatic shore and some five miles into the Marmara from the center of the city (the mouth of the Golden Horn) are the idyllic Princes Islands, traditionally named from their role as a seat of exile for royalty in Byzantine times (395-1453). Of these islands (*adalar*), four today are inhabited in significant numbers. These range in size from Büyük Ada (Great Isle, Gr. Prinkipo), through Heybeli Ada and Burgaz Ada down to Kınalı Ada (Gr. Prōti). In addition to their permanent populations, the islands, as important resorts, attract numerous summer residents and visitors.

Topography, Communications, Climate.—Almost the entire metropolitan area, including suburbs, is extremely hilly. The attempt to demonstrate that old Constantinople, the "New Rome," was built like its prototype upon seven hills is not convincing, but there are few regions in the city where a commanding eminence does not offer a view over steep hills and shining waterways. The somber colors of unpainted wood houses and of coral tile roofs are everywhere broken by clumps of trees, the cypress being especially prevalent.

Communication and transportation between the several regions of Istanbul are complicated by the rugged terrain, the many waterways, and the fact that all except the few new or recently burned-over and rebuilt sections of the city are characterized by very narrow and crooked cobblestone streets. Two bridges span the Golden Horn. At its mouth is the Galata Bridge, a floating structure which can be opened to permit the passage of ships. This bridge carries from Galata to Yeni Cami (the New Mosque quarter of old Istanbul) all tram traffic crossing the Golden Horn. Further up that inlet is the newer Atatürk Bridge. Old Istanbul and Galata-Beyoğlu have adequate tram systems, the latter including a line along the European shore of the Bosphorus past the village of Arnavutköy, location of the Istanbul American College for Girls, to Bebek, the seat of Robert College (q.v.), the American men's college. A tram system also operates in the Üsküdar-Kadıköy area. In addition, major streets have evolved into fair motor roads, and bus service greatly eases problems of communication. There is, however, no bridge across the Bosphorus. Consequently ferries remain as indispensable as they are characteristic of Istanbul life. One line travels the Golden

* In Turkish, *ç* is pronounced *ch*. Where subsequently used in text, *c* is pronounced as *j*, and *ç* as *sh*.

Horn from the Galata Bridge to Eyüp. Others from the same terminus serve both shores of the Bosphorus, and the Princes Islands. There are also motor vehicle ferries at main points and a railroad car ferry from the Sirkeci Station (in old Istanbul), terminus of the railroad from Edirne and European points, to Haydarpaşa, the railroad on the Asiatic shore of the Baghdad line. West of the walls at some distance along the Marmara shore is the Yeşilköy Airfield served regularly by several major international lines and one of the Middle East's principal landing fields. Here are also located large installations of the Turkish State Airways, which link Istanbul with the rest of the country.

The climate is temperate and continental. Summers are warm but dry and not excessively hot, the surrounding seas not only tempering the heat but also making much of the city itself a summer resort and bathing beach. Winters are cold and damp, December to February constituting the rainy season. Snows are not unusual, although they seldom last long. The beauty of Istanbul and its gardens in spring, summer, and fall has been celebrated by the many writers whom this cosmopolitan center between Europe and Asia has attracted over a period of centuries. Likewise well known are its excellent fruits and vegetables and the fish from the Bosphorus fishing grounds.

Museums and Monuments.—Objects relating to the long and important past of Istanbul and of the provinces governed therefrom have been gathered into the city's uniquely rich museums. The most important are those comprised in the museum-complex of Top Kapu Sarayı (the Grand Seraglio, palace of the Ottoman sultans until the 19th century) on the point of land separating the Golden Horn from the Marmara. These include: (1) the archaeological museums and collections, rich in objects from Anatolia and Palestine-Syria, the great showpiece being the *Sarcophagus of Alexander*; and (2) the Islamic and particularly the Ottoman collections, most notable being the Ottoman rulers' vast living quarters (entirely restored and largely furnished with objects of the times), the Ottoman sultans' treasury and collection of Chinese ceramics, and an unrivaled collection of Moslem implements of war. In addition to the vast Top Kapu Sarayı collections, mention should be made also of the Evkaf Museum near the Süleymaniye Camii (Mosque of Sultan Süleyman the Magnificent) in old Istanbul, another collection of notable creations of Ottoman and Moslem art. St. Sophia (Aya Sofya; see SAINT SOPHIA), the last great gift of Greek genius, the most magnificent architectural monument of the Greek Orthodox world, and for centuries one of the chief mosques of Turkish Istanbul, has been converted by the Turkish Republic into a museum. Aside from the structure itself, it is particularly noteworthy for its Byzantine mosaics which, covered with plaster by the conquering Turks (1453), were uncovered and restored after the foundation of the Turkish Republic (1923).

Apart from Aya Sofya and the great walls, the other remaining Byzantine monuments of Istanbul are of importance chiefly to the specialist. Many were converted by the Ottomans to their own uses. Of those left unchanged the most spectacular are the vast underground cisterns, which still form part of Istanbul's water system. Modern Greek churches in the city are

of no special architectural interest, and there are no outstanding Armenian or Jewish edifices. Nor are the monuments of Galata-Beyoğlu of great architectural interest, except possibly the Tower of Galata, dating from 474-491, which has been used in modern times as a fire lookout.

Ottoman monuments, many of them historically important, are numerous. Chief among them are the imperial mosques, erected by the principal sultans as burial places for themselves and their families. Of a distinctive style, their domes and minarets, crowning many of Istanbul's hills, give the city its renowned skyline. The principal Ottoman imperial mosques include those of Mehmed (Mohammed) II, the Conqueror; Bayezid (Bajazet) II; Süleyman (Suleiman) the Magnificent; Selim I; Ahmed I; and the Yeni Cami (New Mosque), each the center of a quarter bearing its name. Attached to the mosque-complexes are small and circular *turbehs*, in whose floors are the graves of the sultans, their families, and their close associates, while other graves are found around the mosques. Other famous men are buried near fountains, schools, libraries, or other foundations which they established as "good works," not infrequently along the public thoroughfares. This is particularly true of Divan Yolu (the Divan Street), which stretches from Aya Sofya to the Mosque of Bayezid II and which with Ankara Caddesi, formerly Bab-ı Ali Caddesi (Sublime Porte Street), now the principal book market of the city, forms the main artery of old Istanbul.

Other important Ottoman monuments include the twin fortresses of Anadolu Hisar (Castle of Asia) and Rumeli Hisar (Castle of Europe), built on the shores of the Bosphorus near that strait's narrowest part. These were erected before the fall of the city proper into Turkish hands. Of 19th century royal palaces the most important are: (1) that of Dolmabahçe on the Bosphorus shore at Beşiktaş, a principal landmark of the waterfront and frequently used as the residence of the Turkish president when he is in Istanbul; (2) Yıldız Sarayı, a palace-complex atop the hills farther up the Bosphorus and well known as the home of the recluse Sultan, Abdül-Hamid II; and (3) Beylerbeyi on the Asiatic shore.

Quarters of the City.—No section of Istanbul is more famous than that of its bazaars, the great Kapalı Çarşı (covered market) which stands on the slopes of old Istanbul looking down on the Golden Horn. Down from it stretches the principal open market of the city (the Mahmud Paşa Çarşısı). The covered bazaar includes miles of roofed and cobblestoned passages lined with tiny shops. The entire building can be locked at night. Its center is the Bedesten (Bezestan), or principal strong room and depot, formerly a depository of the most valuable wares. With the westernization of the city under the republic, the bazaars have lost some of their color, but their importance as the people's market place continues unabated.

At the head of the Golden Horn and beyond the city's mainland walls lies the quarter of Eyüp, in old-fashioned Moslem eyes the most sacred section of the city, owing to the location there of the mosque and supposed tomb of a companion of the Prophet Mohammed. It is held that the site of the tomb was miraculously revealed to the Ottomans during the siege of the city (1453). Since that date the site has been venerated, and



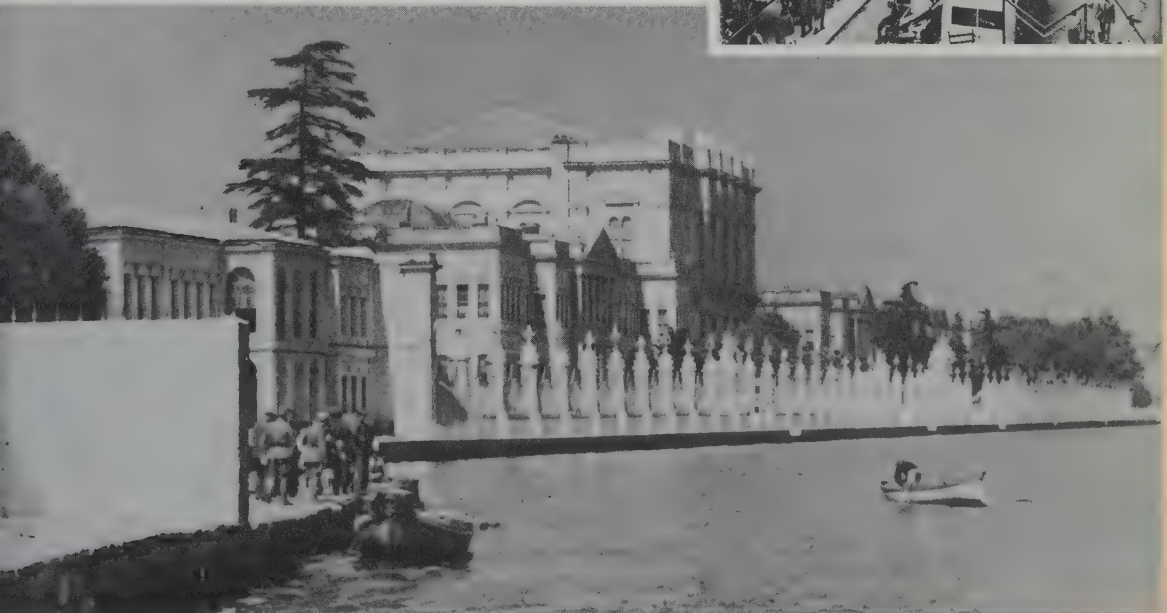
Above: Istanbul is on both sides of the Bosphorus. Into the European portion reaches the bay that is called the Golden Horn, a fine natural harbor shown here at the left of the Galata Bridge, which crosses it.

ISTANBUL

Right: Pera Street is the main shopping thoroughfare of modern Istanbul. It is in the city's newer section across the Golden Horn from the old city.

(Above and below) Philip Gendreau, N.Y.; (right) Wide World Photo

Below: When the president of Turkey visits his country's chief city of Istanbul, he resides in this fine palace on the north shore of the Bosphorus overlooking the Sea of Marmara.





Above: In the old part of Istanbul, on the peninsula between the Golden Horn and the Sea of Marmara, are numerous open markets like this one.



Left: The ruined castle, the unpaved road, and the mounted water carrier are common sights in the villages around Istanbul.

(Above) C. B. Altman from Black Star; (below) Turkish Information Office

Below: The Blue Mosque, or Sultan Ahmed Mosque (17th century), is one of the architectural treasures of Istanbul. It takes its name from the blue tiles that adorn its interior.



until the 20th century it was closed to most Christians. It was the scene of ceremonies at the accession of a new sultan, and around it were created what are historically the most important cemeteries of the Ottoman capital. The vast burial grounds of Üsküdar are, however, far more picturesque. Early in the 20th century the importance of Eyüp began to decline, but it remains in many respects the most Ottoman and one of the most interesting quarters of Istanbul.

Libraries and Education.—During the centuries of Ottoman history, and especially as a result of conquests in Arab lands and in Persia (Iran), Istanbul gradually became and still remains the world's most important depository of Moslem manuscripts. These manuscripts, many of them unique and in a scientific sense priceless, were largely housed in small private libraries erected by individuals. Imperial collections also contained valuable items. The twin tasks of cataloguing and of providing centralized housing for this mass of material, as well as that of cataloguing and systematizing the great mass of official documents left from Ottoman times, have made increasing progress since about 1850, but still remain far from completed.

Centers of interest in the modern city include Istanbul University (q.v.), a large complex of buildings on the site of the Ottoman Ministry of War, housing Turkey's largest center of higher learning. A stately fire tower near the main building is the university's landmark. This tower, with its companion in Galata, remind one that fire, together with not infrequent earthquakes, is still the chief fear of the largely wooden-built city. Until the installation of motorized fire-fighting equipment, conflagrations frequently devastated large sections of the city. With the establishment of the republic (1923), however, the picturesque volunteer fire brigades disappeared as well as the once famous packs of street scavenger dogs, which formerly attracted the attention of all newcomers.

In addition to the university and the Superior Engineering School (near the newer Galata-Beyoğlu section), Istanbul contains numerous other institutions of higher learning, as well as adequate secondary and elementary schools, and is the center of education for the entire nation. In this respect Ankara has only partly supplanted the former capital.

Hospitals and Parks.—A number of good new hospitals, including the Admiral Bristol Hospital (an American Protestant Mission enterprise named for the American high commissioner to Turkey during the post-World War I years) also distinguish the city. Istanbul's several parks, many of them enclosing historic sites or designed to provide vistas leading to such sites, add to its attractiveness. The city also contains the modern İnönü Stadium, center of the football (soccer) matches which are Turkey's leading sports.

Industries.—Istanbul is not a large industrial center, but its tobacco processing plants, glass and shoe factories, gas and electric works, oil company installations, and the many and varied small industries and craftsmen's shops which it contains constitute an important component in Turkey's national economy. The city is the republic's major port of entry—that of export being Izmir (Smyrna)—and the customs houses and harbor works, as well as the shipyards, are vital in the city's and the nation's commerce. Istanbul is also Turkey's financial center.

With the creation of the Turkish Republic, many Stamboules (regular term for citizens of the city) felt that their city was being neglected in favor of the new construction undertaken at Ankara and elsewhere in Anatolia, that Istanbul was being heavily taxed—not in its own interest but to pay for developments in other regions of Turkey—and that it was not receiving a fair share of the new industrial plant which the republic, under its state socialist (*étatist*) program of westernization, was installing in the country. Subsequently these apprehensions were proved partly unjustified and much modernization was undertaken in the city. Nevertheless it remains true that in some respects Istanbul is as much a city of the past as of the present, that it continues more to typify the late Ottoman Empire than the modern Turkish Republic, and that the population of the city, or at least the non-Turkish sections of it, is not in wholehearted sympathy with all of the reforms characteristic of the new Turkey. On the other hand, it must be remembered also that in the late 19th and early 20th centuries Istanbul was the cradle and the principal center of nascent Turkish nationalism (see also *TURKEY—History*) and that it then was and subsequently has remained the center of the Turkish press (daily, periodical, and book), the professions, and the arts. Thus, on the basis of many considerations more important than its size (almost one in every 20 of Turkey's citizens lives in Istanbul), its influence over the rest of Turkey has persisted despite the shift of the capital to Ankara; and Istanbul is still unquestionably modern Turkey's most important city.

History.—Istanbul's uniquely strategic location gives it command of the Bosphorus, a major link in the only sea route from the Black Sea to the Mediterranean. The narrowest point of the Bosphorus, lying within the city limits, is little more than half a mile wide. At the same time, since Istanbul also stands at the easiest crossing between the land routes which descend through the Balkans from central and western Europe on the one hand, and those routes which come from Asia proper through Anatolia (Asia Minor, "Turkey in Asia") on the other hand, the city—together with the general straits area or Marmara region—is as strategically located with respect to land-borne travel and commerce as to that which goes by sea. In consequence Istanbul, which has been traditionally the center of government, commerce, finance, and intellectual activity for the entire Black Sea-Aegean-Balkan-Anatolian area, more than once and for long periods has vindicated her claims to be the naturally endowed seat of the capital of world empire.

The city's history falls into four periods:

(1) Ancient, classical, pre-Christian times—the period of old Byzantium (q.v.).

(2) Byzantine-Christian times, from the re-foundation of the city by Constantine the Great (330) as Constantinople (q.v.) or "New Rome," capital henceforth of the Eastern Roman Empire which eventually became the Orthodox (Greek Christian) state and city and which survived despite all vicissitudes until its capture by the Ottomans in 1453.

(3) Ottoman-Turkish period (1453–1923), during which the city ceased to serve as Christendom's principal bulwark against Islam, but instead became the seat of the last great Moslem world state and the center of Islam's latest and greatest threat to European Christendom.

(4) The most recent period—that of the Turkish republic (after 1923). The Turkish nation discarded much of its previously cherished Moslem tradition, as well as the Levantine type of government and life that had marked the later Ottoman period, and embarked on a course of nationalism and Westernization that entailed the erection of new Ankara in the heart of Anatolia as the modern national capital of new Turkey. Under the republic, Istanbul was reduced to the rank of a provincial capital still overshadowed by its own past glories and characterized, as the rest of new Turkey was not, by sizable non-Moslem and non-Turkish minorities who kept alive some of the Ottoman past that was largely abandoned elsewhere in Turkey.

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ISTANBUL UNIVERSITY, in Istanbul, Turkey, is the oldest and largest university in the country. It is secular, coeducational, and state supported. Like the other Turkish universities, it is guaranteed administrative and academic independence and financial autonomy by the university law of 1946.

The university was founded in 1453, although its history can be traced to ancient times. It underwent many reorganizations, notably in 1896, and between 1923 and 1933. Since 1948, it has comprised six faculties: arts and letters, economics, law, medicine, science, and forestry. In addition, there are schools of dentistry, pharmacy, and foreign languages, and institutes of journalism and economic development. In the 1960's enrollment was approximately 25,000 annually, and the staff exceeded 1,000. The central library housed about 200,000 volumes.

Affiliated with Istanbul University is the Technical University of Istanbul (founded 1883). Civil, mechanical, electrical, and mining engineering, and architecture are the principal subjects. Enrollment in the 1960's exceeded 2,500, and the staff numbered approximately 250. There were more than 50,000 books in the library.

History. Istanbul University is one of the oldest universities in the world. Its roots were already in existence when Constantine I refounded Byzantium as Constantinople in 330 A.D. In 423, Theodosius II reorganized the university, then known as the University of Constantinople, by appointing 31 state-paid professors. By the 500's its faculty of law was comparable to those of Rome and Berytus (Beirut), and by the late 800's the university was a world center for the humanities and philosophy. Under Constantine VII (reigned 913–959) additional chairs of philosophy, geometry, astronomy, and rhetoric were founded, and instruction was being given in arithmetic, music, grammar, law, and medicine. After a brief decline, Constantine IX (reigned 1042–1055) reestablished the university with schools of law and philosophy. However, by 1204

it had again degenerated, and it was moved to Nicaea. It was revived in Constantinople in the late 1200's, but with the decline of the Byzantine empire, the university lost its position as a prominent seat of learning.

On the establishment of the Ottoman empire in 1453, Mohammed II revived the university as the Turkish University of Constantinople. Between 1470 and 1475, 16 new colleges were added. In 1555, Suleiman I further expanded the university and made it one of the largest and most progressive of its age. The decline of the Ottoman empire in the 1800's was reflected in the failing fortunes of the university. Theology became the principal subject, and advances in sciences and general education were largely ignored. However, Selim III (reigned 1789–1807) founded an engineering school, which later became the Technical University of Istanbul, and Mahmud II (reigned 1808–1839) established a faculty of medicine. Then a new organization, the Ottoman University of Istanbul, was founded in 1870. Modeled after contemporary European universities, it included departments of law, philosophy, literature, natural science, and mathematics. The university declined in the next decade, and the medical and law schools functioned autonomously.

The modern University of Istanbul dates from 1896, when Abdul-Hamid II completely reorganized the old faculties. By the early 1900's, departments of theology, mathematics, and literature were operating successfully. The faculties of medicine and law were brought into the university. When the Republic of Turkey was founded in 1923, the university received a fresh impetus. It was provided with funds from the state budget, placed under the jurisdiction of the ministry of education, and completely divorced from its previous religious affiliations. A general modernization took place in 1933, when many new buildings and laboratories were added.

ISTHMIAN GAMES, is'mē-ən gāmz, were a festival of ancient Greece, celebrated on the Isthmus of Corinth, in honor of Poseidon. The festival was also known as the *Isthmia*. The athletic competitions usually were held in the spring of the first year and the summer of the third year of each Olympiad, the four-year interval between the Olympic festivals. The contests included foot races, strength and endurance tests, four-horse chariot races, horse racing, wrestling, boxing, and quoit and javelin throwing. Victors were adorned with crowns of celery or parsley.

In Greek legend, the origin of the Isthmian Games is ascribed variously to Poseidon, Theseus, and Sisyphus. By 581 B.C. the games had taken definite shape as a Panhellenic festival.

ISTHMUS, is'məs, is a narrow strip of land running through a body of water and connecting two larger land areas. The word is of Greek origin, possibly deriving from *ithma* (step), and was first applied to the land passage between the Peloponnesus and the Greek mainland, known as the Isthmus of Corinth.

Other famous isthmuses are the Isthmus of Suez, joining Asia and Africa; the Isthmus of Panama, connecting North and South America; and the Isthmus of Perekop in the Soviet Union, joining the Ukraine with Crimea. The isthmuses of Panama and Suez are crossed by the world's two most famous sea-to-sea canals, the Panama and the Suez.

ISTLE, ist'lē, is a hard vegetable fiber obtained from several species of plants of the genera *Agave* and *Bromelia*, especially *A. lophantha* var. *poselgaea* and *B. sylvestris*. The fiber is also called *ixtle*, *tula*, or *tampico*, the latter for the port of Tampico, Mexico, which ships large quantities of it. Istle is used for cordage, sacks, belts, hammocks, and mats. It comes from the *cogollo*, or central spike, of unopened leaves of the agave or bromelia. The leaves are separated by hand and scraped on both sides with a dull-edged knife so as to release the fiber lying immediately under the epidermis. Istle-yielding plants grow wild in the southwestern United States, Mexico, Central America, and parts of South America. They are cultivated for their fiber chiefly in the Mexican states of Coahuila, Nuevo León, San Luis Potosí, and Tamaulipas.

ISTRIA, is'trē-ə, is a peninsula in northwestern Yugoslavia, in the Croatian republic. It extends about 60 miles south from the Karst plateau into the Adriatic Sea, between the gulfs of Trieste (on the west) and Veliki Kvarner (on the east). The area of the peninsula is about 1,545 square miles, and the coastline extends some 265 miles.

Istria is chiefly an agricultural area, populated by Slavic and Italian peasants. Important products include cereals, fruits, lumber, and cattle. Olives, olive oil, and wines figure prominently in its export trade. Extractive products include alum, bauxite, coal, marble, mercury, and salt. There is also considerable fishing along the Istrian coast, and summer resorts abound. The most important city is Pula (1961 population, 37,403), a port, naval base, and industrial and shipbuilding center on the west coast near the southern tip of the peninsula. North of Pula are the port towns of Poreč and Rovinj. The large port of Rijeka (1961 population, 100,989) lies just east of Istria's northeast border.

History. Istria was already inhabited when the Romans conquered it in 177 B.C. It remained nominally under Byzantine rule after the fall of the Western Roman empire, but was overrun by Lombards and Goths. In 788–789 A.D., it was annexed by the Franks as the Carolingian march of Istria. Subsequent overlords included the dukes of Carinthia and the patriarchs of Aquileia. In the 900's, Istria was united to the duchy of Bavaria.

By the 1400's, Austria and Venice had absorbed the northeastern and southwestern portions respectively. The Treaty of Campo Formio (1797) and decisions of the Congress of Vienna (1815) gave the Venetian portion to Austria. In 1915, according to the Treaty of London, Italy was promised Istria and other Austrian territory as a reward for her entrance into World War I on the side of the Allies. By the Treaty of Rapallo (1920), this promise was fulfilled. The bulk of Istria was transferred to the Italian department of Venezia Giulia e Zara.

In the summer of 1945, following the collapse of Germany in World War II, the peninsula was occupied by Yugoslav forces. The Treaty of Paris (1947) gave most of the peninsula to Yugoslavia, while the northwestern sector became the Free Territory of Trieste. By an international agreement in 1954, the city of Trieste and a small area of adjoining land was returned to Italy. The greater portion of the former free territory went to Yugoslavia.

ISVOLSKY, is'vôl-skē, **Aleksandr Petrovitch**, Russian diplomat: b. Moscow, Russia, March 18, 1856; d. Paris, France, Aug. 18, 1919. At the age of 22, Isvolsky was sent on a mission to Pope Leo XIII, which resulted in the reestablishment of Russian relations with the Vatican and his own appointment as Russian chargé d'affaires. He was successively minister to Serbia (1897–1900) and to Japan (1900–1902). In Tokyo he tried to overcome the resentment felt in Japan against Russia, which had compelled Japan to yield territory on the mainland of Asia which it had won in war against China (1894–95). He was unsuccessful, and in 1904 Japan and Russia were at war.

Isvolsky became foreign minister of Russia in 1906. The next year he negotiated an agreement with Great Britain that eased some frictions between the powers. In the diplomatic crisis that followed Austrian annexation of Bosnia and Herzegovina in 1908, he tried to secure from Turkey the right for Russian warships to pass from the Black Sea through the Dardanelles and the Bosphorus to the Mediterranean Sea. But the failure of this effort weakened his position at home, and he retired from the foreign office in 1910. He served as ambassador to France from 1910 to 1917.

ITAGAKI, ē-tā-gā-kē, **Taisuke**, Japanese political leader: b. Tosa province (now Kochi prefecture), Shikoku, Japan, April 17, 1837; d. Gifu, Aug. 16, 1919. He founded the first political party in Japan and was a steadfast fighter for political freedom and liberal constitutional government. When an attempt was made on his life in 1882, he is said to have remarked: "Itagaki may die, but liberty will live."

Itagaki received a military education and commanded troops of the Tosa clan in the service of the emperor during the struggle that overthrew the shogunate and restored the Meiji regime in 1868. From 1871 to 1873 he was councillor of state to the emperor. He then resigned to become the center of a movement for constitutional government. Itagaki favored a constitutional system like Britain's rather than the strong monarchy, like Germany's, that was finally adopted in 1889. However, as a fervent nationalist, he was willing to sacrifice some popular rights for strong government.

Early in 1878 he established a private school in Tosa devoted to teaching the principles of democratic government. This school gained great popularity, and Itagaki became known as the "Rousseau of Japan." Japan was then thought to be on the point of revolution, and the government, feeling the pressure of public demand, invited Itagaki into the cabinet. He accepted appointments as minister of public works in 1878 and minister of the interior in 1880.

In 1881 he organized the *Jiyuto*, or Liberals, the first Japanese political party. In the 1890's, with the goal of parliamentary government accomplished, he lost interest in politics. However, he continued to hold cabinet posts until he retired in 1900. He was made a count in 1887.

ITALIAN EAST AFRICA, Italy's former possessions in East Africa. See ETHIOPIA; SOMALIA, REPUBLIC OF.

ITALIAN SOMALILAND. See SOMALIA, REPUBLIC OF.

ITALY, it'ā-lē, is a republic of western Europe. It is a key member of the North Atlantic Treaty Organization and the European Economic Community. An illustrious land with a civilization dating back several thousand years, Italy has enriched the world since the days of ancient Rome with its brilliant achievements in the arts, sciences, religion, government, and law.

Modern Italy was not united until 1861. It was ruled by the house of Savoy from 1861 to 1946, when the Italians voted to replace the monarchy with a republic.

Italy's area of 116,303 square miles is divided into 20 regions. Rome is the capital. The estimated population of Italy in 1965 was 52,520,000 (1961 census: 50,623,569).

The Italian name for the country is *Italia*. Its national flag is a tricolor of green, white, and red vertical stripes. The national anthem is the *Inno di Mameli* (*Hymn of Mameli*), a famous anthem of the Risorgimento—the movement for the liberation and unification of Italy in the 1800's. The basic monetary unit is the lira (622.38 lire equaled US\$1 in 1965). The metric system is used for all weights and measures.

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1. THE LAND. Geographical Position.—

Italy lies in the same latitudes as the eastern United States from northern Maine to southern Virginia. Mainland Italy is the middle peninsula of the three that form the southern extension of Europe. The Mediterranean Sea forms three basins around the peninsula—the Tyrrhenian Sea on the west, the Ionian Sea on the south, and the Adriatic Sea on the east. Italy is bounded on the north by the great mountain chain of the Alps. South of the peninsula, and separated from it by the narrow Strait of Messina, is the Italian island of Sicily. Italy also includes the island of Sardinia, west of the peninsula, some small islands off the coast of Africa in the Mediterranean Sea, and minor groups of islands in the Tyrrhenian Sea. The island of Corsica, just north of Sardinia, falls within the geographic zone of Italy but belongs to France.

With the exception of the boundary with Yugoslavia, the present limits of Italy were fixed in the peace treaty signed between the Allied and Associated Powers and Italy on Feb. 10, 1947. In general, the French-Italian border is marked by the watershed of the western Alps. The watershed of the central Alps forms the frontier with Switzerland and Austria, except that the upper basin of the Ticino River and a small part of the upper basin of the Adige River belong to Switzerland. Before World War II, the natural line of the Julian Alps was the boundary with Yugoslavia. By the peace treaty of 1947, Italy ceded to Yugoslavia most of the Istrian peninsula and the upper basin of the Isonzo River. The port of Trieste, however, with a small surrounding territory (277 square miles in all), was made a free territory.

The free territory was the subject of continuous dispute between Italy and Yugoslavia. It

was finally partitioned between them in 1954. The city of Trieste and most of the northern part of the territory was transferred to Italy; the remainder went to Yugoslavia.

Two independent states are entirely surrounded by Italy: the republic of San Marino (23 square miles, near the northern Adriatic coast), and Vatican City (109 acres in Rome), the temporal dominion of the pope.

The Setting.—The Italian peninsula extends into the Mediterranean like a huge boot more than 720 miles long and 80 to 150 miles wide. The distance across the Strait of Otranto, between the southeastern end of the peninsula and the Balkan Peninsula, is only 44 miles; the distance between Sicily and Africa is 90 miles. The Sicilian city of Messina is about midway between Gibraltar and the Suez Canal. Because of this central location, Italy has always played a prominent role in the Mediterranean.

Seacoast.—The length of the Italian coastline is about 4,971 miles, of which 2,237 belong to the mainland and 2,734 to the larger and smaller islands.

The northwestern coast on the Ligurian Sea is high and steep because the mountains are close to the water. The coast bends to form the wide Gulf of Genoa. The port of Genoa is the outlet of the most important industrial districts of Italy. The Gulf of La Spezia, at the eastern end of the Riviera, is less wide.

On the western side of the peninsula, the coast of the Tyrrhenian Sea forms a series of sickle-shaped gulfs separated by high promontories. The wide splendid Bay of Naples, surrounded by an exceptionally fertile plain, attracts the greatest part of the maritime activity of southern Italy.

The Ionian seacoast, on the south, is generally straight and lacking in good harbors. The chief port is Taranto, on the Gulf of Taranto.

The Adriatic coast on the east is also generally poor in harbors. Brindisi and Bari acquired some importance in the 20th century because of trade with the Middle East. Ancona, sheltered by Monte Conero, is one center of maritime trade between Italy and the Balkan Peninsula. In the extreme north, where the coast is low with many lagoons and marshy tracts, is the port of Venice.

In Sicily, the best ports are on the northern coast (Palermo) and the eastern coast (Catania and Syracuse). The Sardinian coast has few good harbors except in the south (Gulf of Cagliari).

Geomorphology.—Italy is divided into four geomorphic regions: (1) the internal or southern slopes of the Alps; (2) the plains of the Po and Venetia; (3) the peninsula, with Sicily; and (4) Sardinia.

The Alps.—The Alps belong to the family of young Mediterranean chains (Alpids) in which folding continued during all of the Tertiary period. They are a series of big and often very irregular corrugations separated from each other by longitudinal valleys, which form deep furrows. The highest tracts of the ridges are ordinarily found in the middle portion, where crystalline rocks (granite, gneiss, schists) predominate. In the western portion (Italo-French Alps) this higher ridge slopes precipitously toward the plain of the Po; but in the central portion (east of Lake Como) and in the eastern portion the higher ridge is bordered by chains of a lesser

altitude made up of sedimentary rocks with limestone predominating. These are the Outer Alps (Prealpi).

Along the French border are the chains of the Maritime, Cottian, and Graian Alps. Then, proceeding east along the Swiss and Austrian borders are the Pennine, Lepontine, and Rhaetian Alps, and then the Dolomites. To the east are the Carnic and Julian Alps, the latter largely Yugoslav. The highest peak is Mont Blanc (Monte Bianco), in France, which reaches 15,781 feet. All of the peaks over 13,000 feet are in the central Alps with the exception of the French Mont Pelvoux and the Italian Gran Paradiso, in the Graians, which is 13,323 feet high. In the Pennines are Monte Rosa (15,217 feet); the Matterhorn (Mont Cervin; Monte Cervino), Swiss and Italian, which is 14,780 feet high; and Dent d'Herens (Swiss and Italian, 13,690 feet). Monte Viso, in the Cottian Alps, is 12,601 feet high. The highest peak in the Dolomites is Marmolada (10,964 feet). These higher mountains, as well as many others attaining more than 10,000 feet, are covered with large glaciers, the limits of permanent snow being between 8,200 and 9,200 feet.

The Alps are indented by deep transverse valleys, situated in a normal or oblique direction to the geographical axis of the chains. These valleys (such as the Adige) reach the heart of the mountainous region and lead to passes which facilitate the crossing of the system. The passes become gradually lower from west to east; that is why the eastern portion of the Alps is generally easier to cross than the western part.

The Plain of the Po.—At the foot of the Alps extends the largest Italian plain, formed by the hydrographic basin of the Po and of the Venetian rivers (Adige, Piave, Tagliamento). This plain covers about 17 per cent of Italy's total area, and from an agricultural and industrial standpoint, it is the most important region of Italy. The more elevated portion is devoted to grain and mulberry trees. In some of the drier parts agriculture must be assisted by irrigation. In the lower portion, in contrast, there are still some wet and marshy parts which require drainage. This portion is devoted to the two main agricultural products of Italy, rice and fodder grass. Cultivation of the latter results in a flourishing butter and cheese industry. Along the Adriatic coast there was in antiquity a succession of lagoons, but many of them were reclaimed beginning in the 16th century.

The Apennines.—The Apennines form, orographically but not geologically, the continuation of the Maritime Alps along the Gulf of Genoa, and they stretch down the whole peninsula to the Strait of Messina. The name Apennines applies, however, only to the middle chains, which, in the northern portion (Tuscan and Umbrian Apennines), are situated in succession from west to east like the wings on a stage, gradually approaching the Adriatic Sea. In the central and highest portion, within the limits of Abruzzo, the Apennines form two or three main ridges enclosing highlands and elevated basins. In the southern portion (Campania and Calabria) they divide into clusters and groups separated by low areas. The geological formation and external aspects of the Apennines are varied in the different portions. On the whole, however, the scenery of the Apennines is not so impressive and picturesque as the Alpine scenery, because of the

lower altitude, the lack of glaciers, and the smaller amount of water—the last due mainly to the fact that the mountains have been gradually deprived of their vegetation. The highest group of the Apennines is the Gran Sasso (Monte Corno, 9,560 feet). Other groups which attain a considerable altitude are the Sibillini (Monte Vettore, 8,127 feet), Monti della Laga (Monte Gorzano, 8,055 feet), the Terminillo (7,261 feet), the Maiella (9,170 feet), the Velino (8,160 feet), and the Mèta (7,372 feet).

The passes from the Tyrrhenian toward the Adriatic slope are numerous but, especially in the central portion, they are at a great altitude and are therefore obstructed by snow in winter.

Some isolated elevations on the Tyrrhenian side form the so-called Antiapennines, of volcanic formation. On the peninsular portion of Italy only one active volcano is found, namely, Vesuvius (Vesuvio, 3,858 feet), but several other volcanoes, still active in the Quaternary period, have retained their characteristic aspect. Such are the Amiata, in southern Tuscany (5,689 feet), the groups of the Vulsini, Cimini, Sabatini, and Albani, in Latium; the volcano of Roccamonfina (3,291 feet), in Campania; the Campi Flegrei where, as recently as 1538, a volcanic eruption resulted in a new mountain called Monte Nuovo; the Epomeo (San Nicola, 2,589 feet), in the island of Ischia, still active in the 14th century; and Monte Vulture (4,357 feet), Basilicata. On the Adriatic side, isolated elevations are Monte Gargano, the spur of the boot of Italy (3,465 feet), and the plateau of the Murge, which has very little water.

The plains of the peninsula are few and small. Along the Tyrrhenian Sea, the Maremma and the Pontine marshes have been both reclaimed in the 20th century. Farther south is the very fertile plain of Campania. Along the Adriatic Sea the Tavoliere of Apulia and the plains of Salento are found. In the inland portion some small plains amid the mountains were occupied by lakes in quite recent geological times. One of these lakes, Fucino, was drained only in the 19th century by means of an artificial effluent.

The mountains of northern Sicily are considered a continuation of the Apennines beyond the Strait of Messina. The highest group, called Le Madonie, is only 6,780 feet high. But Sicily has a thoroughly isolated and active volcano, Mount Etna (10,758 feet). South of this mountain extends the largest plain of the island, the Piana di Catania.

Sardinia.—Sardinia, with the French island of Corsica, forms a distinct portion, because it is probably the remains of a more ancient land (Tyrrhenys) which occupied a part of the Tyrrhenian Sea prior to the formation of the Italian peninsula. Ancient geological formations are therefore prevalent in Sardinia, where they form the framework of isolated mountain groups, the highest of which is Monti del Gennargentu (6,017 feet). Other fragments of ancient Tyrrhenys are the island of Elba and the elevations of southern Tuscany. Sardinia, Elba, and southern Tuscany are also the only really important regions from the viewpoint of mineral products. Useful minerals are scarce in Italy, where fossil fuels in the proper sense are lacking. In Sicily much sulphur is found; the Apuan Alps yield the well-known Carrara marble; the western Alps, a little iron; and the Trentine Alps, some metallic minerals.

Climate.—The complexity of the physical structure of Italy is increased by the remarkable climatic differences in the various regions, so that it is impossible to speak accurately of a "climate of Italy." The latitude range of $10^{\circ}29'$ between the extreme north and south would be sufficient in itself to cause considerable differences in temperature. But, in addition, the peninsula stretches far into the Mediterranean Sea, where seasonal alternations are felt only by a superficial layer of 1,000 feet, while all the remaining water down to the bottom has an almost constant temperature of 55°F . In winter, the Mediterranean is therefore a reservoir of warmth; in summer it is relatively cool. The influence of the Mediterranean thus accounts for mild winters and moderately hot summers. The farther a region is from the sea, the less this influence is felt, and in continental Italy the influence of the Mediterranean is almost negligible. However, the mountainous bulwark of the Alps protects this area against cold north winds and, in general, against the atmospheric influences of the north. The Alpine shelter is remarkably reduced in the eastern portion (the Venetian region and Istria), and here the northern influences are often felt in the severely cold and violent winds called *bora*. A climatic influence is also exerted by the Apennines. Because of this mountain system, the influence of the western winds from the Atlantic is limited to the Tyrrhenian side of the peninsula, and in the northern portion the favorable influence of the Tyrrhenian Sea is limited to the narrow southern slopes of the Ligurian Riviera.

With regard to temperature, Italy is broadly included between the annual isotherms of 52° and 66°F .; the coldest period occurs in December and January, the hottest in July and August. In the plain of the Po the average annual temperature is about 55°F .; in Sicily it is about 64° —a difference of 9° in relation to a distance of about 500 miles. The difference would certainly be greater but for the Alpine bulwark and the tempering action of the Mediterranean Sea. In continental Italy, the differences of temperature between summer and winter are very remarkable; in the central portion of the plain of the Po, differences of 36° – 43°F . between average July and January temperatures are observed; in the inland portion of the peninsula also, in the mountainous regions of the Apennines—for instance, at L'Aquila—such differences exceed 36°F .

Even more remarkable are the differences in rainfall. In the Alpine region the rain is more and more copious as the altitude rises; in the eastern Alps and Outer Alps, as well as in the mountains between Lago Maggiore and Lago di Como, the annual precipitation exceeds 80 inches. The same amount is found also in some of the higher portions of the Apennines exposed to the western winds. The driest portions are the low areas far from mountainous elevations. In the eastern plain of the Po, a small area receives less than 24 inches, and rainfall is no greater in the Tuscan Maremma and the plains of Latium. (The general average in the north, however, is about 50 inches.) The Tavoliere of Apulia, the southeastern portion of Sicily, and the southern plains of Sardinia receive less than 20 inches.

No less important than the annual rainfall is the manner in which it is distributed in the various seasons. In the whole area of Italy south of the Tiber (Tevere) and Tronto rivers,

including the larger islands, rain falls mostly in winter, and the summers are very dry. This phenomenon is typical of the Mediterranean climate. In Apulia, Sicily, and Sardinia there are three months with practically no rain at all. Such a long drought is likely to damage crops and pasture, and the need of water for agricultural purposes is keenly felt. In the center of the Alps, on the other hand, rainfall shows a tendency to concentrate in summer. During the winter there is a copious fall of snow which covers the ground for a long period. The same conditions are shared by the plain of the Po. The freezing of rivers, however, is almost unknown; even in the Venetian lagoon, freezing rarely occurs.

In some regions the climate is often modified by local conditions. Such is the case of the waters of the large subalpine lakes which exert a mitigating influence not unlike that of the Mediterranean. This is why, on Lago Maggiore and on Lago di Como and Lago di Garda, there are resorts with a Mediterranean climate. Again, in the center of the Alps, some well-sheltered valleys and some dells (such as the Merano dell) have a mild and dry climate. The mild climate of the Ligurian Riviera is celebrated; this region is encircled by the Apennines and opened southward to the favorable influence of the Tyrrhenian Sea.

Rivers.—The characteristics of the Italian rivers are determined by morphological and climatic conditions. The largest of them originated in the area bounded by the Alps and the Apennines, which was covered by the sea until the Quaternary period. The Po is the only river which crosses the whole plain from west to east; its course is about 420 miles long, with a drainage basin of some 29,000 square miles. The river is subject to two periods of high water. The principal one takes place around June; the lesser one in October. The low-water periods occur in January and August. Some of its Alpine tributaries, such as the Ticino, Adda, Oglio, and Mincio, have an ample, clear, and regular flow because they are fed by the Alpine glaciers and by many springs, and because they cross the large subalpine lakes, which act as regulators and clear their waters. On the other hand, the Apennine tributaries of the Po, such as the Tanaro, Trebbia, Taro, Secchia, and Panaro, are impetuous in the mountainous portion of their courses, irregular, and full of sediment. This is carried by the Po into the Adriatic, where the delta of the river, though subject to various alterations, is steadily increasing. It did not exist in the time of ancient Rome and was built up in the last 20 centuries. The importance of the different mouths has varied from time to time; the greatest volume of water is carried at present by the Po della Pila. The Po is subject to violent and disastrous floods; therefore, the entire lower course of the river, downstream from Cremona, has been securely dammed. As a waterway, the river has had little importance. Great works are in progress, however, with a view to opening a waterway from the Adriatic to Milan and Lago Maggiore.

The large northern plain is also crossed by the Adige and by some others of the longest Italian rivers, such as the Piave, the Tagliamento, and the Isonzo. In length, the Adige is third among the Italian rivers (220 miles). Its upper course is mountainous and often narrow and en-

ITALY

CONIC PROJECTION

SCALE OF MILES



- Capitals of Countries ★
- Regional Capitals ☆
- Provincial Capitals △
- International Boundaries ---
- Regional Boundaries ---
- Railroads ---

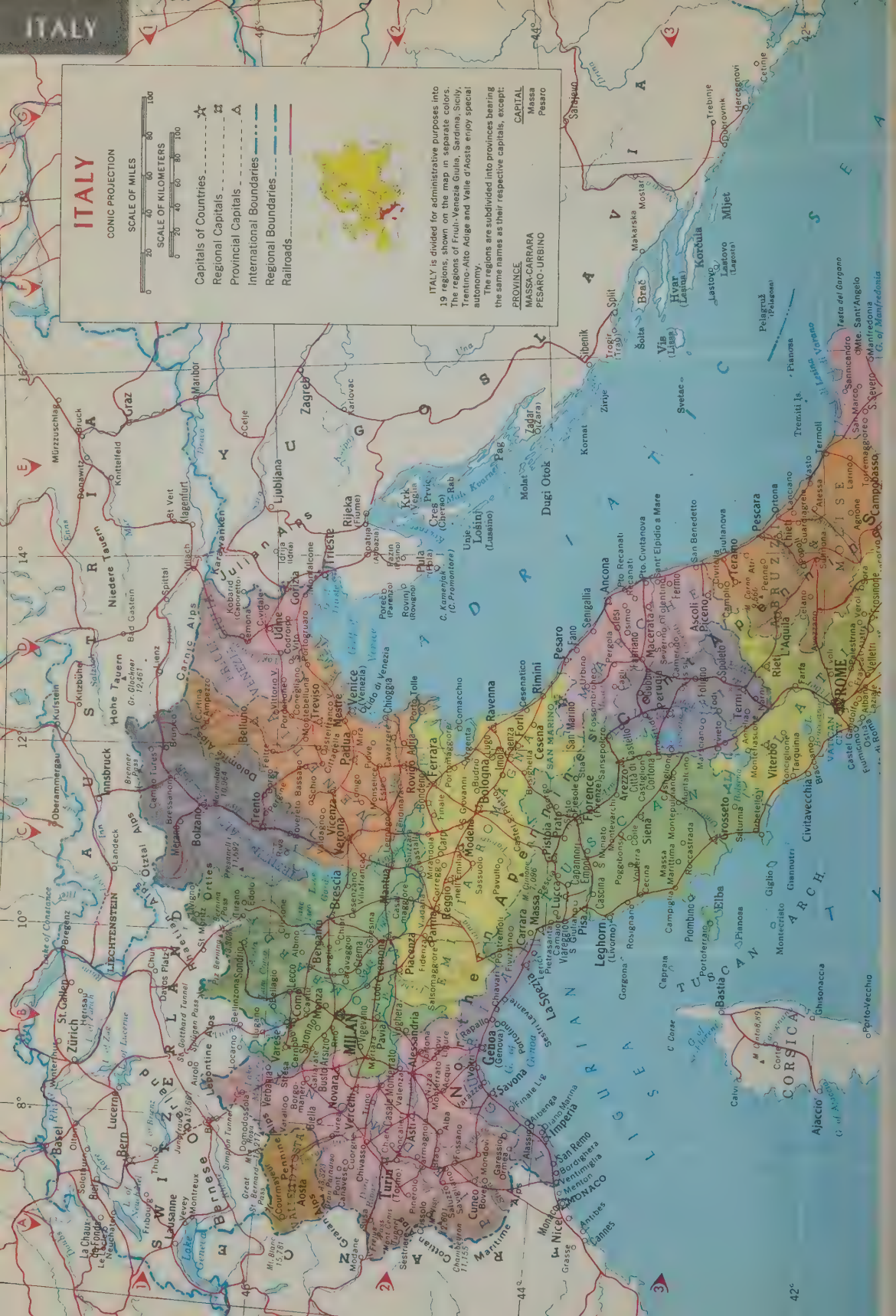
ITALY is divided for administrative purposes into 19 regions, shown on the map in separate colors. The regions of Friuli-Venezia Giulia, Sardinia, Sicily, Trentino-Alto Adige and Valle d'Aosta enjoy special autonomy.

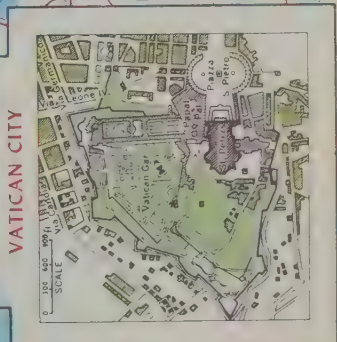
The regions are subdivided into provinces bearing the same names as their respective capitals, except:

PROVINCE

MASSA-CARRARA
PESARO-URBINO

CAPITAL
Massa
Pesaro





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Longitude 12° East of Greenwich 14° 16° 18°

ITALY (Continued)

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closed. After the gorge called Chiusa di Verona, famous in military history, the river enters the plain. In its lower course, the Adige has often shifted its bed; it is subject to violent floods and is navigable only by small craft.

The rivers of the peninsula portion of Italy are characterized by a considerable slope, especially in their upper courses, and by irregularity, with floods in spring and low water in summer. The rivers which empty in the Adriatic and Ionian seas flow in short transverse valleys; the longest of them are the Tronto, Pescara, and Ofanto. On the Tyrrhenian side more important rivers are found. The Tiber, which is a little longer than the Adige (244 miles), carries the waters of the principal mountainous groups of the central Apennines and has some notable tributaries, among them the Nera and the Aniene. Its lower course crosses the Roman Campagna. On its delta there was in antiquity the port of Rome, called Ostia, now filled with earth because of a very conspicuous alluvial process. Other notable rivers on the Tyrrhenian side are the Tuscan river Arno, north of the Tiber, and the Liri and Volturno south of the Tiber.

In Calabria and northeastern Sicily there are characteristic torrents, called *fiumare*, which are quite waterless during many months of the year and muddy and impetuous in the rainy season.

The Italian rivers are of little importance for navigation. However, the rivers of Alpine Italy are profitably used for irrigation, and above all for the production of electric power. For the same purpose, important plants have also been established on some rivers of the peninsula, such as the Aniene and the Nera, and on some rivers of Calabria, Sicily, and Sardinia.

Lakes.—The Italian lakes are divided into two main groups. The first includes the large subalpine lakes—Lago Maggiore or Verbano, Lago di Como or Lario, Lago d'Isèo or Sebino, and Lago di Garda or Benaco. They were all formed by ancient valleys once occupied by the extensive glaciers of the ice age, and are barred at the lower end by the terminal moraines of these glaciers. Their shores, favored with a mild climate, are thickly settled. The second group is in the Antiapennines and consists mostly of lakes which occupy the craters of ancient volcanoes. Such are the lakes of Bolsena, Vico, Bracciano, Albano, and Nemi. In contrast, Lago Trasimeno occupies a low area which is the remainder of a larger but very shallow basin. Other lakes, such as Fucino, have been drained.

Several small lakes are scattered along the coast of Latium, Campania, Apulia, and Sardinia; some have been reclaimed in the 20th century. There are also numerous artificial lakes or reservoirs for the production of electric power; some of the largest of these are found in the Venetian Alps, in Calabria, and Sardinia.

Plant and Animal Life.—In a country with such an ancient civilization as Italy has the natural landscape, as affected by the conditions of climate and soil, has been deeply modified by man. Mountain flora, with relics of the ice age, is found in the Alps above 6,500 feet, and in the Apennines above 7,200 to 7,900 feet. The belt of highest woods was originally, and is still partly, formed by conifers, but it was severely damaged by deforestation, which began in the Roman period and has been very actively pursued ever since with the exception of some pauses during the early Middle Ages. Below this altitude is a

belt of such plants as beeches (still found in some regions of the eastern Alps and Outer Alps and of the Apennines), oaks, and chestnut trees. Oak woods, very widespread in antiquity, have suffered the heaviest damages from deforestation, particularly in the central and southern Apennines and in Sicily. Extensive oak woods still remain in Sardinia, however.

The plain of the Po has also thoroughly changed its original aspect. In the higher portion, which is very dry, there were once extensive areas with a scanty vegetation. These were later taken over for tillage by means of irrigation. Some small pieces of untilled territory, known variously as *brughiere*, *groane*, and *magredi*, still remain in Piedmont, Lombardy, and the Venetian region. In its lower portion, the plain was formerly covered with many marshy areas subject to floods, where poplars and willows thrived. But today the plain is almost entirely tilled, largely with cereal grains, rice, and hemp, or given over to pasture.

In the peninsula and in the larger islands, the hilly and level areas as well as the larger inland valleys were and still are the domain of Mediterranean vegetation. A natural formation was the *macchia*, or bush, with evergreen trees and such shrubs as holm oak, cork trees, juniper, bramble, mastic, broom, laurel, myrtle, and dwarf palm. Since remote times man has eradicated this natural vegetation in extensive areas and replaced it with other growths, chiefly the olive tree, an appropriate emblem of the Mediterranean regions. Other cultivated plants are vines, and some fruit trees such as figs and almonds. Lemon and orange trees were imported in more recent times. Wheat thrives almost everywhere, but in the south and in Sicily it is often damaged because of the irregularity of rainfall. Among recent growths are sugar beets and tobacco. A typical feature of the Mediterranean landscape was the maritime or Italian cluster pine in the coastal areas, but there are few such pine groves left.

As for the animal kingdom, the primitive fauna has been thoroughly modified by man. The larger mammals are almost extinct. Bears are found very rarely in both the Alps and the Apennines, where they still live in a very small protected area. Wolves are still common in the peninsula but are no longer found either in the Alps or in Sicily. Wild stags and deer survive in Sardinia; chamois are still spread in the Alps. The large birds of prey are also disappearing; among the birds characteristic of Italy, ravens and swallows may be mentioned. In the peninsula and in the islands, countless lizards are found.

All the domestic animals have been present since the most remote times. Cattle and pigs are prevalent in continental Italy, whereas sheep prevail in southern Italy and in the islands, where pastures are poorer. In the same southern regions, there are also many donkeys and mules. Buffaloes were imported from Asia, and some semiwild herds of these mammals still survive in the coastal plains of southern Italy.

ROBERTO ALMAGIÀ,
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2. THE PEOPLE. The Land and Its Earliest Inhabitants.—Italy, in its present geographical structure, is of comparatively recent origin. The Alps and the Apennines, which form its skeleton, had already emerged from the Pliocene sea in the Tertiary period, together with the

greater part of the continent of Europe, but the Po Valley and the plains to the east and west of the Apennine chain date from the Quaternary or, to be more exact, Lower Pleistocene period. This fact explains the scarcity of primitive peoples in Italy and the small quantity of Paleolithic (Old Stone Age) relics left behind them. Flint objects of the Pleistocene period, made in the Mousterian style, have been found, and from bones discovered in Rome and Latium between 1929 and 1939, we know that they were produced by a type of man living in the Riss-Würm interglacial stage about 50,000 years ago. This was Neanderthal man, thinly but widely distributed over many parts of Europe. His distinguishing marks were a long, narrow (dolichocephalic) skull, a low-swung face, a prominent occiput, a sloping forehead with a thick, bony visor just above the eyes, a wide nose, a receding chin, a strong, stocky body, and skin that may have been dark in color. He had a spoken language, made arms and tools, used fire both for heat and for cooking, and knew how to protect himself with what means he had against the cold and the wild animals around him. Later, other anthropological types made their appearance in Italy, including the Grimaldi who lived in Liguria, only to disappear, leaving no traces behind them. See also section on *History*; MAN, PREHISTORIC RACES OF; STONE AGE.

Pre-Roman and Latin Peoples.—The history of the human race in the second millennium before Christ is complex and for the most part little known. In northern Italy, peoples of pre-Indo-European stock, among whom we may single out the Ligurians, developed a Neolithic (New Stone Age) civilization. They buried their dead. Elsewhere in Italy, ancient groups of Sardinians, Corsicans, and Elymi, whose linguistic classification is still uncertain, were superseded by the first wave of Indo-European-speaking peoples, who eventually made up the Latinian and Sabelian branches of the Italic subfamily. In the north, around 2000 B.C., the first metals (copper, and then bronze) appeared, incineration was introduced, and dwellings were built on piles north of the Po, and, later, fortified villages of pile dwellings laid out in a geometrical plan on the dry land south of the river. This was the civilization known as terramara, related to the later (9th to 6th century B.C.) Villanova civilization which spread gradually over the central and southern parts of Italy. The Villanova civilization arose as a second wave of Indo-European-speaking peoples entered Italy, and from it came the third branch of the Italic subfamily, the Osco-Umbrian.

In the course of their expansion, these peoples discovered iron. From their contacts with the predecessors of the Etruscans, or, as some scholars think, with the Etruscans (who had migrated from Asia Minor between the 10th and 8th centuries B.C.), there arose along the northern part of the Tyrrhenian coast what we know as the Etruscan civilization.

This period marks the end of Italian pre-history. Peoples of Illyrian origin, Iapyges in the south and Veneti in the north, settled on the shores of the Adriatic, while Greeks colonized and civilized the coastal zones of the far south (Magna Graecia) and Sicily. Waves of barbarian invaders of Celtic stock, whom the Romans called Gauls, descended on northern Italy. They drove the older inhabitants toward the south and even ventured as far as the young city of Rome,

from which they were driven back at the end of the 4th century B.C. It is impossible to determine what portion of the Ligurian, Etruscan, and Italic peoples stayed on in the northern plains after the Celtic invasions. There are, however, signs of a thorough anthropological mixture, particularly in the plains south of the Po.

The Romans were endowed with military prowess and with an incomparable talent for spreading civilization, and were thus able to carry out the task of unifying this heterogeneous aggregation of peoples, first imposing their political rule, and then their laws, culture, language, and thought. In the time of Augustus (r. 27 B.C.—4 A.D.), Italy was completely Romanized, although its regional division showed recognition of its varied origins. The unity created by the Romans did not give way before the barbarian invasions of the 5th and 6th centuries A.D., in which peoples of Germanic, Slavic, and even Mongol origin took part. It continued to develop until *latinitas* (Latinity) finally became the distinguishing characteristic of the Italian people. See also section on *History*.

Language and Dialects.—The language introduced into the provinces of the Roman Empire by Roman soldiers and civil authorities was not literary Latin but a popular speech which took root everywhere, absorbing local forms and customs, and evolving in different ways. Numerous Latin dialects developed, but the people who spoke them had to use a simplified and provincial form of standard Latin in official documents and in their communications with Rome and other parts of the empire. The passage of centuries brought with it the outgrowth from the various kinds of regional speech of the primitive Italian dialects, which are the prototypes of the dialects still spoken in modern Italy.

The replacement of local dialects by a standard literary language was a particularly slow process in Italy, because educated people were for a long time reluctant to give up Latin, which was still used in public papers and in the liturgy of the Roman Catholic Church. But the flowering at the beginning of the 12th century of Provençal poetry, whose widespread imitation stimulated literary exchanges among the various regions, led in the early 13th century to the predominance of the Tuscan dialect, generally considered the nearest to classical Latin. The position of Tuscan was strengthened by the tremendous influence of Dante Alighieri (1265–1321), followed by Petrarch (Francesco Petrarca, 1304–1374) and Giovanni Boccaccio (1313–1375). In this way, the Italian language came into being, and in the succeeding centuries other distinguished writers increased its importance as one of the world's great languages.

The general effect of linguistic unification was to reduce the number of differences among the various dialects. There are still fairly marked variations of vocabulary, accent, and pronunciation, but Italians of the upper and middle classes write and usually speak a standard language, which public education, the newspapers, the radio, motion pictures, and the development of communications and travel have brought into general use.

The linguistic unity of persons of Italian origin (among whom we must count the inhabitants of the Swiss canton of Ticino, of the cities of the Dalmatian coast of Yugoslavia, and of the island of Corsica) is shown by the very

small number of Italian citizens who habitually use other languages or dialects (Slav, German, French, Albanian, Greek, Catalan). The majority of these foreign-language citizens live along the northern border. According to the 1921 census, there were 801,923 of them, or about 2.1 per cent of the general population, and about 45 per cent lived in the northeastern territories awarded to Italy after World War I and transferred in 1947 to Yugoslavia and the Free Territory of Trieste. The census of 1936 registered 109,000 persons of foreign nationality living on Italian soil. (See also sections on *Language* and *Literature*.)

Anthropology.—When we speak of the racial make-up of the Italian people, we do not refer to the three major groups (white, Mongoloid, and Negroid), since, with the exception of a few thousand Mongols who took part in the invasions of Attila (452 A.D.) and other barbarian leaders, the ancestors of the modern Italians were all of the white group. Rather, we refer to the various branches or subdivisions of the white group to which they belong.

The groups which over the centuries came to form the Italian people were themselves, to a certain extent, of varied origin, and some of these groups intermarried with other peoples. This explains the difficulties encountered by anthropologists in their attempts to classify the few skeletons which have come down from prehistoric times. It is important to note, however, that after the unification of the Roman Empire and the end of the period of the barbarian invasions there were no mass movements of population. The sporadic immigration of Germans, Normans, Arabs, Slavs, Catalonians, and Albanians had little influence on the make-up of the Italian people, and in any case their presence is recorded in history and we can take it into due account. Aside from the large cities, we may say that the anthropological composition of modern Italy is not very different from what it was in the time of Augustus. This simplifies many genealogical problems and permits us to concentrate on contemporary racial composition and distribution, which in turn shed light on the problems of the past.

In order to get our bearings, let us look at Table 1. In the first column are listed the regions of Italy prior to World War II; in the second, the average heights, in centimeters, of 20-year-old males from these regions who were born in 1908; in the third, the average head measurements (corrected), expressed in terms of the cephalic index (for definition, see ANTHROPOLOGY), of 20-year-old soldiers born between 1859 and 1863. The remaining columns give the frequency per 1,000 among these same soldiers of blond hair, blue eyes, and a fair complexion.

The greatest heights are found in Venezia Giulia (most of which is no longer part of Italy) and Veneto—168.28 centimeters (5 feet 6¼ inches) and 167.14 centimeters (5 feet 5¾ inches), respectively—and as we proceed west and south, the heights become progressively smaller. Throughout the north, however, they remain over an average of 166 centimeters (5 feet 5½ inches). In the heart of central Italy, the average is 163 centimeters (5 feet 4 inches); it decreases steadily thereafter, reaching its lowest point in the south and the islands. The absolute minimum, found in Sardinia, is 160.89 centimeters (5 feet 3⅓ inches). With regard to stature, therefore, we may divide Italy into three

areas—the northeast, where the men are fairly tall; the northwest and center, where they are of medium height; and the south and the islands, where they are short.

Glancing again at Table 1, we find high cephalic indexes (indicative of brachycephalic, or short, wide heads) in the Veneto region and in Venezia Giulia. The very highest figure, however, occurs in Piedmont (84.9), in the extreme northwest, where heads are nearest to a round shape. Lower averages are found in Emilia, Lombardy, and possibly in Venezia Tridentina, and still lower ones in Tuscany, Marche, and Umbria. If we consider as fairly roundheaded all measurements over 82½, then we may say that all of northern Italy (except Liguria) and the northern part of central Italy are definitely brachycephalic. Farther south, dolichocephalism (long-headedness) prevails increasingly. Sardinia again shows the lowest figure (76.5).

The data on pigmentation, in the last three columns of Table 1, follows that of head measurements, with high figures in Piedmont and Lombardy and low ones in Sardinia. In summary, we may say that in the brachycephalic regions there are fairly numerous examples of light hair, eyes, and complexion, but in the dolichocephalic regions these traits are rare and the population must be considered definitely dark in coloring.

Table 1—BASIC ANTHROPOLOGICAL TRAITS
ADULT ITALIAN MALES

Region ¹	Average quantitative traits		Average qualitative traits (per 1,000)		
	Height (centimeters) ²	Cephalic Index ³	Blond hair ³	Blue eyes ³	Fair complexion ³
Piedmont	166.39	84.9	124	136	488
Liguria	166.78	81.3	105	105	456
Lombardy	165.84	83.4	101	134	497
Venezia Tridentina	165.51	84.0?	?	?	?
Veneto	167.14	84.0	126	157	468
Venezia Giulia and Zara	168.28	84.2	?	?	?
Emilia	166.18	84.2	72	94	385
Tuscany	166.23	82.3	92	104	434
Marche	163.78	83.0	75	101	314
Umbria	163.97	83.1	90	117	415
Lazio	164.53	80.0	64	83	353
Abruzzi and Molise	162.73	80.9	66	85	376
Campania	162.83	81.1	68	84	310
Apulia	162.33	78.8	57	76	303
Basilicata	160.94	79.8	48	67	311
Calabria	162.08	77.4	38	55	251
Sicily	162.54	78.6	50	77	283
Sardinia	160.89	76.5	17	40	183
All Italy	164.72	81.7	82	103	386

¹ Pre-World War II regional division.

² Based on corrected measurements of 20-year-old males, born 1908.

³ Based on data on 20-year-old soldiers, born 1859–63.

Referring again to history, we may note the following allied facts:

(1) The northwest regions correspond in a general way to the territory invaded by the Celts, who dispossessed the former Ligurian, Etruscan, and Italic inhabitants. Indeed, the Romans called this region Cisalpine Gaul. Here we have found medium heights, brachycephalic heads, and predominantly dark coloring, with, however, a sizable number of blonds.

¹ Some authorities class all measurements between 80.1 and 83 as subbrachycephalic.

(2) The regions of Veneto and Venezia Giulia were invaded by the Illyrians, and Augustus called by the name of Venetia the whole northeastern section of Italy bordering on Illyrium. In this area are the greatest average heights in Italy, combined with brachycephalism and a high frequency of light coloring.

(3) Many of the central and southern regions bear the names of ethnic groups belonging to the great Italic-speaking subfamily which formerly occupied them, and some recall the era of Greek colonization. South of the 43d parallel (which runs about 70 miles north of Rome) begins the area of short stature, increasing dolichocephalism, and darker coloring.

(4) The middle ground between the 43d and 45th parallels includes Liguria and Tuscany on the west, which have medium heights and fairly small head measurements, and the regions of Emilia (where the terramara peoples lived), Marche, and Umbria, where there were frequent and sometimes violent contacts between the old Italic and Etruscan inhabitants and the later Celtic and Illyrian invaders.

Before passing from these notes to a fuller interpretation of the anthropological data at hand, we must take into consideration a number of points. First, other traits should be weighed. Of particular importance are the height of the cranium, the relative width of the nose, and the relationship between the length of the torso and that of the legs. In addition, we should eliminate from the averages given in Table 1 the influence of heterogeneous urban populations. Besides the averages, we should take into account the distribution of anthropological traits and the relationships among them. Moreover, we should consider the various ways in which hereditary traits are transmitted, and we must not forget the influence of geographical, social, and nutritional factors. Research has been done along these lines, but we must confine ourselves to remarking that all these points have their place in our discussion.

The average physical traits of the Piedmontese, and to a lesser degree of the Lombards and Tridentines, correspond to those usually attributed to peoples of Celtic stock. Actually the word Celtic is more properly applied in the field of linguistics, and the traits in question are not shared by all peoples of Celtic stock, nor are they the exclusive property of this stock. The modern term Alpine is preferable, describing as it does an abstract anthropological group of medium height and stocky physique, roundheaded and with prevalently dark coloring. The ways in which the traits of the Alpine people of Italy are transmitted by heredity, however, make us suspect numerous mixtures and amalgamations with people of very different physical characteristics, and the frequency in its most representative elements of numerous subjects of light coloring goes far to confirm this suspicion.

These Alpine peoples are bordered on the east by the Venetian and Julian Venetian descendants of ancient Illyrian invaders. Their fairly tall stature and brachycephalism, combined with dark coloring and other traits, roughly correspond to those of the so-called Dinaric type, which is found in all the Venetian regions as well as along the coast of Yugoslavia. This type, too, is racially mixed, for the cranial and pigmentary data is almost certainly hybrid, and the frequency of blonds is another index of irregularity. There is more consistency in the matter of height, a factor

of great anthropological importance among these Adriatic peoples.

Let us look now at the south of Italy and the islands. Here the population is descended from many overlapping stocks—pre-Italic, Phoenician, Greek, and Italic. Under anthropological analysis, however, it is shown to be remarkably homogeneous, though not to such an extent, for example, as the Scandinavian population. For this reason, its most conspicuous traits—low stature, a long, narrow head, and dark complexion—are said to characterize a human type called Mediterranean. This type is widespread along the coasts of the Mediterranean Sea; it is most concentrated and uniform in Sardinia.

Are we to consider the modern Ligurians, with their head measurements approaching dolichocephalism, as representatives of the Mediterranean type? And the Tuscan descendants of the Etruscans, with measurements only slightly larger? We cannot exclude this possibility, although there is other contradictory data, based on the fact that Tuscany is part of the middle ground of central Italy, where there was such a great mixture of ethnic stocks. This mixture was especially pronounced in Emilia.

In conclusion, three of the major European racial types, in a more or less pure form, all of them with dark coloring, go to make up the population of Italy: the Alpine, the Dinaric, and the Mediterranean. There are, on the other hand, very few examples of the Nordic or East Baltic types.

Demography.—Growth of Population.—There is quite a difference between the few hundred men of the prehistoric era and the 1948 Italian population of 46,403,000. This population was not built up by immigration except during the pre-Roman and Roman periods and the 5th and 6th century barbarian invasions. Since then its growth has been due entirely to the predominance of births over deaths, and emigration has not altered the favorable balance. Since this growth has taken place over a period of 4,000 years, the average annual rate of increase has been slow: about 1 per 1,000. (Table 2 shows the population of Italy from the death of Augustus to 1948, with a forecast for the year 2050.)

Table 2—POPULATION OF ITALY

Year	No. Inhabitants
4 ¹	6,500,000
1500 ¹	11,600,000
1700 ¹	14,100,000
1800 ¹	18,124,000
1901 ²	32,475,253
1911 ²	34,671,377
1921 ²	37,973,977
1931 ²	41,176,671
1936 ²	42,918,726
1946 ²	44,994,000
1947 ¹	45,539,000
1948 ¹	46,403,000
2050 ³	56,800,000

¹ Estimate. ² Census. ³ Forecast.

Note: All figures are for area within political boundaries at the respective dates, and are not therefore entirely comparable.

According to calculations made by historians, the rate of increase was even lower in the period from the beginning of the Christian era to 1500, amounting to only about .4 per 1,000. After this time, however, under the influence of favorable European conditions and the Industrial Revolution, the population increased at a much faster rate, particularly during the 20th century. The maximum of 10.6 per 1,000 was reached in 1936–1941, after which the rate declined. If prophecies

based on complex mathematical calculations are correct, there will be a decrease to less than 2 per 1,000 by the year 2050.

The density of population in 1948 was approximately 399 persons per square mile. It is true that other European countries—for example, Belgium, the Netherlands, and the United Kingdom—are more densely populated, but the Italian population problem is a serious one because of the mountainous nature of the terrain, the lack of mineral resources, and the poor condition of much of the soil, brought about by 3,000 years of unscientific agricultural practices.

Trades and Professions.—Occupational classifications may be made in various ways, two of which deserve mention here. The first and simpler way is to list all persons no longer infants according to their gainful activity. The Italian census of 1936 registered 33,728,406 persons over 10 years of age, of whom 18,345,432 exercised a trade or profession. Table 3 shows the division

Table 3—POPULATION OVER 10 YEARS OF AGE ENGAGED IN TRADES AND PROFESSIONS CENSUS OF 1936

Trades and professions	Number engaged		Number engaged per 1,000	
	Total	Males only	Total	Males only
Agriculture	8,756,064	6,328,531	477.3	483.1
Hunting and fishing	86,721	83,181	4.7	6.4
Industry and handicrafts	5,375,152	3,997,779	293.0	305.2
Transportation and communications	702,201	667,049	38.3	50.9
Commerce	1,504,820	1,068,285	82.0	81.6
Banking and insurance	100,543	88,242	5.5	6.7
Arts and letters	142,958	108,893	7.8	8.3
Public administration	808,866	575,938	44.1	44.0
Private administration	81,059	29,693	4.4	2.3
Religion	126,323	74,938	6.9	5.7
Domestic service	660,725	75,901	36.0	5.8
Total	18,345,432	13,098,430	1,000.0	1,000.0

according to occupation of persons registered by the census. We note that 8,756,064 persons, or approximately 47.7 per cent of the total employed population, were engaged in agriculture.

The second method disregards age and divides the entire population into families, listing the trade or profession of the head of each family. According to this method of calculation, there were in Italy in 1936, 3,628,000 families whose head worked in agriculture (38 per cent of the total), and these families included 18,385,855 persons, or 42.8 per cent of the total population. This fact has particular social significance, because it shows that the members of many agricultural families have left the land and taken up other occupations.

All the major trades and professions except agriculture are concentrated in the large cities, and because of the enormous increase of industrial and commercial activity since the late 19th century, there has been a correspondingly heavy increase in the population of urban centers. In 1946, there were 70 cities with more than 50,000 inhabitants and a total population of approximately 12,400,000, or 27.5 per cent of the total; and 26 cities with over 100,000 inhabitants and a

total population of 9,250,000, or 20.5 per cent of the total. The five cities with present populations of more than 500,000 increased as follows between 1901 and 1947: Rome, 462,783 to 1,573,994; Milan, 491,460 to 1,267,550; Naples, 563,540 to 977,946; Turin, 335,656 to 712,983; and Genoa, 234,710 to 649,367.

Religion.—The question asked by census takers in Italy concerning religion has, in recent years, been interpreted as having an official meaning. That is, it aims at establishing in which religion a person was born or reared rather than at ascertaining what his actual beliefs and church attendance are. This, then, is how we must interpret the figures of the 1931 census, which show that 99.6 per cent of those registered were Roman Catholics, .34 per cent belonged to other faiths, and only .06 per cent declared that they had no religion or were unwilling to make any statement. The small minority of 139,719 persons belonging to other than the Roman Catholic Church included 83,618 Protestants, 33,381 of whom were foreigners, and 47,825 Jews, of whom 8,713 were foreigners.

Vital Statistics.—The rapid increase in the Italian population in the 20th century, as shown in Table 2, is due to the fact that many more persons have been born than have either died or emigrated. The number of births hovers around 1,000,000 per year, while the number of deaths is about 500,000. (Birth, death, marriage, and emigration rates are given in Table 4.) As in

Table 4—MARRIAGE, BIRTH, DEATH, AND EMIGRATION RATES (per 1,000 inhabitants)

Year	Marriages	Births	Deaths	Emigrants
1881-1885	8.1	38.0	27.3	5.36
1901-1905	7.4	32.7	22.0	16.82
1911-1915	7.4	31.5	19.1	15.46
1921-1925	8.4	29.5	17.3	7.87
1931-1935	6.8	23.8	14.1	2.19
1936-1940	7.6	23.2	13.8	1.11
1941	6.1	20.9	13.9	0.19
1942	6.4	20.5	14.3	0.18
1943	4.9	19.9	15.2	...
1944	5.0	19.2	15.9	...
1945	6.8	18.3	13.8	...
1946	7.6	22.8	12.3	1.17
1947	9.4	21.9	11.4	3.16
1948	8.3	21.5	10.6	2.93

most civilized countries, the birth rate has declined in Italy in the 20th century independently of the number of marriages. In 1948, the birth rate (21.5 per 1,000) was only about 56 per cent of what it had been in 1881-1885 (38.0 per 1,000). In the same period, the death rate declined from 27.3 to 10.6 per 1,000.

The decline of the death rate is an important sign of civic progress in culture, public health, and material welfare. Evidence of this progress is shown in detailed fashion in Table 5, which compares the life spans of Italians in 1881 and 1941. From this table, we learn that whereas in 1881 only 788 of 1,000 males reached the age of 1 year, 592 reached 10 years, and 412 reached 50 years, in 1941 the corresponding figures were 908, 858, and 725, respectively. The death rate for males during the first year of life was 212.4 per 1,000 in 1881, but declined to 91.8 per 1,000 by 1941, a difference of 57 per cent. The difference for persons 10 years of age was 76 per cent; for those 50 years of age, 41 per cent. The life span of the average male increased from 35.2 years in

Table 5—LIFE SPAN OF THE ITALIAN PEOPLE, 1881 AND 1941
(per 1,000)

Age	Number reaching specified age				Death rate				Life expectancy (years)			
	1881		1941		1881		1941		1881		1941	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
0	1,000	1,000	1,000	1,000	212.4	191.3	91.8	75.1	35.2	35.7	57.6	60.9
1	788	809	908	925	109.2	108.2	30.3	25.8	43.5	43.0	62.4	64.8
2	702	721	881	901	53.3	53.6	8.1	7.9	47.8	47.1	63.3	65.5
3	664	683	874	894	33.1	33.6	5.5	5.1	49.4	48.8	62.8	65.0
4	642	660	869	889	23.9	24.0	3.4	3.3	50.1	49.4	62.2	64.3
5	627	644	866	886	17.9	18.7	2.6	2.5	50.3	49.6	61.4	63.6
10	592	606	858	878	5.9	6.5	1.4	1.3	48.2	47.6	56.9	59.1
15	578	589	852	872	5.0	6.1	1.6	1.6	44.3	43.9	52.2	54.2
20	561	569	841	862	8.2	7.9	3.2	3.0	40.6	40.4	47.9	50.2
30	514	520	817	837	7.9	9.8	3.2	3.1	33.8	33.7	39.1	41.9
40	471	468	781	806	10.6	10.9	6.3	4.2	26.4	26.9	30.7	32.9
50	412	415	725	765	17.4	14.6	10.2	7.4	19.5	19.6	22.6	24.4
60	326	337	628	690	31.7	30.1	21.7	16.0	13.2	12.9	15.3	16.4
70	200	207	450	525	74.0	79.7	50.6	45.0	8.2	7.8	9.2	9.8
80	67	63	186	241	145.2	151.3	136.8	122.7	5.0	4.9	4.9	5.2
90	8	7	20	30	248.6	246.5	285.4	275.9	3.1	3.2	2.7	2.7
100	....	....	....	....	365.6	347.4	449.2	462.5	2.1	2.3	1.7	1.6

1881 to 57.6 years in 1941, or 63 per cent. A similar though less marked increase took place in this period for all age groups up to 70.

Other signs of improved social conditions, and particularly of public health, are seen in the data concerning causes of death. Fig. 1 shows that from 1907 to 1939, except for the years of World War I, there were progressively fewer deaths from diseases of the heart, tuberculosis, and infectious diseases in general. There was a setback

the destruction during the war of many reclamation projects and the movement of thousands of refugees. In general, however, there were no such epidemics as had occurred during World War I (cholera in the army, and influenza), and the few outbreaks of contagious diseases (smallpox, typhus) were quickly put down by an efficient public health organization, which provides the services of a doctor, midwife, and pharmacist in even the smallest villages.

Emigration.—Because of the density of the population and the poverty of the country, in past decades many Italians went abroad to make their livings. We note from Table 4 that during the first 15 years of the 20th century approximately 16 out of every 1,000 inhabitants emigrated each year. Some of the emigrants returned to Italy, but not in proportions to equal the number of those who left. During the period of heaviest emigration about 250,000 persons, mostly men and many of them skilled northern workers, went each year to other parts of Europe, while an additional 400,000, mostly peasants and day laborers from the south, went to the United States and South America. During World War I, the emigration rate was reduced to one seventh of its former level, but by 1920 substantial emigration had resumed. Later, restrictions on immigration imposed by various countries (such as the United States Immigration Act of 1924), and the economic and military policy of the Fascist government reduced emigration to negligible proportions. Among the policies of the new democratic postwar government has been the encouragement of emigration on a substantial scale, particularly to France and Argentina. Net emigration in 1946 amounted to about 53,000 persons; in 1947, to about 144,000; and in 1948 to about 136,000.

Many of those who emigrated at the beginning of the 20th century made their homes abroad and became citizens of their adopted countries. The United States census of 1940, for example, listed 1,561,100 persons of Italian birth. Italy has benefited from the emigration of the past, which relieved overpopulation and unemployment, and emigrant remittances helped to cover international financial commitments. Particular benefit accrued to the south, which centuries of bad government, poor soil, and difficulties in establishing modern industry had made into the least progressive part

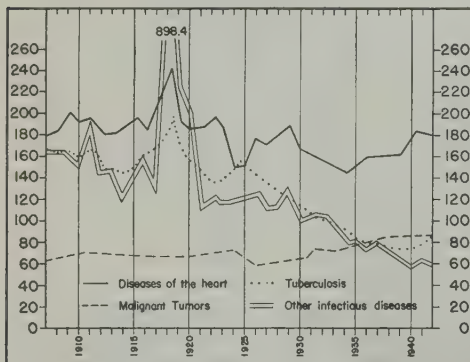


Fig. 1. Death rates from selected causes per 100,000 population in Italy, 1907 to 1942.

in 1941–1942, especially in the case of tuberculosis, as a result of World War II, during which the national income was reduced to 60 per cent of the prewar figure, and nutrition, which was based on carbohydrates and had lacked fats and proteins even in better times, declined to little more than 2,000 calories per day for an adult male.

In contrast to the general trend, we note an increase, dating from 1926, of deaths due to malignant tumors. This may be accounted for in part, however, by more accurate diagnoses than those made in the past.

Two characteristic diseases which had afflicted Italy for a long period seemed to have been almost entirely eliminated on the eve of World War II. These were pellagra and malaria. The first reappeared to a small extent as a result of malnutrition, and the second as a consequence of

of Italy. The countries where the emigrants went were equally benefited. The emigrant is often more enterprising and hence more valuable economically than the man who stays at home. From a sociological point of view, we may note that the emigrant's ability to do hard work and his thrift have done much to dispel the mythical foreign conception of the Italian as lazy and pleasure loving, absorbed in *dolce far niente* (sweet idleness).

Culture.—Elementary schooling is free and compulsory in Italy. There were in 1946, 869,112 pupils attending the 10,599 *asili* (nursery schools or kindergartens), which had 20,552 teachers; and 4,357,137 pupils in the 35,252 public and private elementary schools, with 133,004 teachers. It was estimated that 90 per cent of the children in the age group between 6 and 14 were attending school. There were in the same year 675,732 students attending secondary schools, including art and technical schools. University students numbered 189,663.

These figures are of interest less for the present state of education than as an index of the future. If we speak of culture in the highest sense, we cannot properly measure it even from the data furnished by the 1936 census regarding the number of persons engaged in the most honored professions, shown in Table 6, for it omits

Table 6—PERSONS ENGAGED IN CULTURAL OR PROFESSIONAL ACTIVITIES, CENSUS OF 1936

Classification	Number engaged	Number per 100,000 population
Heads and teachers of secondary schools and colleges.....	188,736	439.7
Roman Catholic priests and ministers of other sects.....	150,234	350.0
Physicians and pharmacists.....	40,095	93.4
Lawyers, notaries, etc.....	35,567	82.9
Prefects and other public and private officials.....	24,442	56.9
Engineers and architects.....	22,285	51.9
Painters, sculptors, and musicians.....	15,393	35.9
Chemists, physicists, and naturalists.....	5,425	12.6
Writers and editors.....	1,236	2.9
Diplomats.....	936	2.1
Total.....	484,349	1,128.3

many persons with university degrees, both publicly and privately employed. Only a relatively small number of the persons listed in the table make a direct contribution to Italian culture, but it is largely among the professional groups that we must look for those who before World War II produced the 25,000 books and 4,000 periodicals printed each year by Italian publishers, and the 1,000,000 readers at the public libraries, who borrowed more than 2,500,000 volumes. Here, too, we shall find those who visit art galleries, attend concerts and lectures, and support intellectual, artistic, and scientific development.

Way of Life.—There are great differences of outlook, customs, and living conditions among the Italian peasants, who make up the largest part of the population. There is the mountain dweller, who must break rocks in order to plant a small field; the prosperous farmer of the irrigated valleys of Lombardy; the tenant farmer who receives only a modest income in money or produce; his richer counterpart in Tuscany and Emilia; the shepherd of Abruzzi, the Maremma section, and Sardinia, who shares the solitary and nomadic life of his flocks.

Beside this varied rural way of life, there is another, thousand-year-old urban civilization. We must remember that as late as 1860 Italy was still divided into seven small, independent units, some of which had two capitals. There were, then, seven separate courts, each with its own ceremonies, nobility, clergy, bankers, and hangers-on of every kind, in addition to other, even more numerous, cultural and economic centers, some of which were the former capitals of vanished republics and principalities. This explains the wealth of monuments, art collections, archives, and historical libraries found throughout Italy, and the great number of bishoprics (282), universities and other institutions of higher learning (about 40), academies, and educational centers.

Apart from its position as the center of the Roman Catholic Church, Rome has none of the metropolitan character of Paris, London, and New York. Milan, Turin, and Genoa are greater industrial centers, as are many smaller cities and their suburbs. There are few great factories for the mass production of uniform goods; in fact, even such machine-made products as automobiles and watches are often turned out by skilled artisans whose talent and ingenuity make up for the lack of technical organization. The industrial census of 1937-1939 listed 217,893 manufacturing plants, of which only 87 employed more than 2,000 workers, and 804,646 handicraft industries, of which 786,000 employed fewer than 5 workers. Italian industry and handicrafts are known for the excellence and refinement of their production. Celebrated the world over for their quality are Florentine jewelry, Venetian lace and embroidery, Murano (Venetian) glass, leatherwork and gloves, faience ware, the wooden statuary of the Italian Alps, the marble sculpture of Florence, and the corals of the coastal towns near Naples.

The cities, laden with memories and monuments of antiquity, and still holding out against the encroachment of heavy industry, are perhaps the most obvious demonstration of the Italian's strong attachment to tradition. Another aspect of this attachment is the retention of some very old legal and social institutions, such as the rural *mezzadria*, a medieval form of arrangement between landowners and their tenants whereby the former are paid by receiving exactly half the produce of their land.

The Protestant Reformation hardly touched Italy, and nearly the entire population belongs, at least in a formal sense, to the Roman Catholic Church. Religious faith is usually deep and sincere despite occasional manifestations of outworn custom and superstition. Religious beliefs, whether or not they are accompanied by church attendance, have a solidifying influence on family life. Divorce is prohibited. The infrequency of homicide (15 cases per 1,000,000 inhabitants in 1939), suicide (69 per 1,000,000), and death from chronic or acute alcoholism (10 per 1,000,000) bear witness to self-discipline and moral balance.

In a few districts the capital invested in industry or the natural fertility of the soil have produced good living conditions. On the whole, however, the poorer classes suffer much economic hardship.

The Italian character varies considerably from one part of the country to another. The Italian of the northwest is cold and reserved, accustomed by business dealings to concentration and prudence. The central Italian, particularly the Tus-

can and the Umbrian, has a more open nature, and the southerner is highly imaginative and very much of an extrovert, witty and exuberant in words and gestures. It would be an error, however, to conclude that the southerner is a superficial wastrel. The people of the Naples area, for example, have to their credit the accomplishment of having turned a wasteland into a garden, bringing all the water from underground, and succeeding with great effort in raising five or six crops of fruit and vegetables a year.

There are many ancient holiday celebrations in Italy. These create local rivalry or bring the people together in a community effort which usually ends with banquets of regional food and wine. Among the more famous of these celebrations are the *Palio delle Contrade*, municipal races between the wards of Siena, held in July and August; the regattas of Venice; the *scoppio del carro*, a religious procession which takes place at Easter in Florence; the October wine festivals in the country around Rome; the Piedigrotta festival of Naples, with its song competitions (see section on *Music*); and the *ceri* (candlelight celebrations) of Catania. The night festivities of the Feast of the Redeemer (third Sunday in July) in Venice are particularly beautiful because of their illumination. The entire city is decked out with Japanese lanterns, and fireworks are mirrored in the lagoon. Good Friday is observed in Umbria and other places with a ghostly torchlight procession following an image of Christ's body.

To these popular celebrations must be added the biennial art exposition and the periodic motion-picture festival of Venice, the *Maggio musicale* of Florence, and the art competitions held every four years in Rome. In addition, sports are popular, and large crowds turn out for soccer and boxing matches and for automobile and bicycle races.

World War II changed many habits and had its effect on the spirit of the Italian people. Against the old individualistic and conservative background we see new currents and aspirations toward a more democratic form of government. Old Italy, which has often been called "the country with a thousand lives" may emerge from the troubled postwar period with a new aspect whose exact form we cannot as yet imagine, but whose success should be forwarded by a past history rich in experience and glories.

Italian Contributions to Modern Civilization.—The time is past when one could look at the history of one's native land with the same narrow pride which leads a father to consider his own child superior to all other children. The modern temper is practical and cosmopolitan, and its evaluations are made on an objective basis, taking into consideration only the fundamental contributions made by the various peoples of the world to present day civilization.

If we study Italy's more than 2,500 years of recorded history, we shall find a very large number of these contributions. We see first the spread of Roman civilization among the barbarians, which left behind it permanent traces. The Latin language was the vehicle of its transmission, and its chief expression was in the field of law, where it created the legal conceptions of private property and the family, and in a westernized form of Greek art and philosophy.

When the Roman Empire finally crumbled

away, Italy again assumed leadership through the Roman Catholic Church, which extended to all men the religious and social principles of the Gospel, by means of a common liturgy and by its juridical and political structure. For several centuries, European culture was entirely a product of Catholicism, with St. Thomas Aquinas (1225?–1274) and Dante as its most representative figures.

Meanwhile, the geographical boundaries of the world were steadily enlarging. In the international rivalry for new routes and the discovery of new lands, a number of Italians, among them Christopher Columbus (1446?–1506) and Amerigo Vespucci (1451–1512), played a major role. As the known world grew larger, men strove to widen their intellectual horizons. This was the aim of humanism, which arose among a small group of Italian scholars, anxious to recover the classical values of Greek and Roman culture, and subsequently spread all over Europe. This movement had leaders in every country of western Europe, so that beside the Italian Count Giovanni Pico della Mirandola (1463–1494) we find the Dutch Desiderius Erasmus and the English Sir Thomas More. Humanist ideals were not confined to a small circle; rather, with the assistance of Renaissance art, as exemplified in such figures as Leonardo da Vinci (1452–1519), Michelangelo Buonarroti (1475–1564), Titian (Tiziano Vecelli or Vecellio, c.1480–1576), and Raphael (Raffaello Santi or Sanzio, 1483–1520), they penetrated every social level and left an abiding influence behind them.

Out of the Renaissance came the 17th century scientific development. No name is greater here than that of Galileo Galilei (1564–1642), who discovered planetary orbits, founded modern mechanics, and gallantly defended the Copernican system. Other great Italian scientists were Santorinus (Santorio Santorio, 1561–1636), a professor of medicine who devised an apparatus for measuring the pulse and a clinical thermometer; Bonaventura Cavalieri (1598?–1647), mathematician who originated the method of indivisibles; Evangelista Torricelli (1608–1647), inventor of the barometer; Marcello Malpighi (1628–1694), founder of microscopic anatomy; and Giovanni Battista Morgagni (1682–1771), founder of pathological anatomy.

It has often been said that Italian culture declined after the 17th century. There is some truth in this statement, if we mean the relative decline brought about by the increase of intellectual effort the world over, and hence a lesser tendency toward monopoly of intellectual achievement on the part of a single nation. It is also true that since the mid-19th century a large portion of scholarly work has depended on collective study and modern apparatus, and so is more easily developed in wealthier countries than Italy. Nevertheless, Italians have made many and outstanding contributions to modern civilization. Italian writers scaled new intellectual heights with the profound philosophy of Benedetto Croce (1866–) and the literary relativism of Luigi Pirandello (1867–1936). Their accomplishments are matched in the field of science by the pioneer work in electricity of Luigi or Aloisio Galvani (1737–1798) and Count Alessandro Volta (1745–1827), inventor of the voltaic pile; by the application of electricity to power production of Antonio Pacinotti (1841–1912), inventor of the dynamo with ring winding.

ITALY

Right: An outdoor grocery store in Marino offering fruits, nutbread, candy, and, strung over the doorway, sausages and cheese.

Bottom left: The winter resort town of Positano, with the beach in the foreground. On extreme left is a Norman fort and watchtower built around 1000 to defend the coast against the Saracens.

Bottom right: The heights of Perugia, an important town in Italy as far back as 309 B.C.; and during the Renaissance, the seat of the Umbrian school of painting.

(Right and bottom left) Paul Pietzsch from Black Star; (bottom right) Ivan Dmitri for American Export Lines



ITALY



Left: The interior of St. Peter's Basilica, Vatican City, with Pope Pius XII and his attendants officiating at the canonization of St. Frances Cabrini, July 7, 1946.

Center: The waterfront of Venice, dominated by the Campanile, overlooking the Piazza San Marco in the center. On the left is the Mint and on the extreme right is the Doges' Palace.

Bottom: The Ponte Vecchio, crossing the Arno River in Florence. On the left is the tower (308 feet) of the Palazzo Vecchio.

(Left) Triangle Photo Service; (others) Trans World Airline



and Galileo Ferraris (1847–1897), who discovered the principle of the rotary magnetic field; by the development of wireless communications of Marchese Guglielmo Marconi (1874–1937); and by the work in atomic energy of Enrico Fermi (1901–). See also sections on *The Arts*; *Literature*; *Science*.

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3. HISTORY. The history of Italy extends over more than 2,500 years in an unbroken series of events. It is this continuity which is responsible for the development of one of the most clearly defined of nations. This is true despite the fact that people of diverse origins, belonging to different states, played prominent roles in that history. The Italian nation is thus very old—the oldest in Europe after Greece. As a modern state, however, it is very young, dating only from 1861. The Italian people appear, therefore, both new and ancient.

The complexity of Italian history and the slow development of the Italian nation are due not only to geographical diversity and the presence of a number of ethnic elements, but also to political and social trends. Perhaps no other European country has lived through so many events, been subjected to so much external pressure, suffered so many invasions. In no other country has the ecclesiastical element, ever since the early Middle Ages, assumed such dimensions and become so much a part of civil life. In no other land since antiquity do we find such disparity between cultural background and historical traditions on the one hand, and political efficiency and national independence on the other. The first element ranked high in Italy, sometimes very high, while the second was usually low or nonexistent.

Archaeology and Prehistory.—Traces of the Lower and Middle Paleolithic periods have been found in most parts of Italy except Sicily and Sardinia. The Upper Paleolithic period is represented in the northern, central, and southern parts of the peninsula, and in the islands as well. To this period belong the Grimaldi, Cro-Magnon, and Maiella types of man. The succeeding Neolithic period left evidence of great progress in both the peninsula and the islands. With it came the pastoral arts and the use of pottery. According to some authorities, pottery was introduced into Italy by foreign invaders; according to others, it resulted from local evolution, possibly as a consequence of foreign influence.

We also find a variety of peoples in this period. Among the ancient Italian peoples of whom we have written evidence, the Ligurians may correspond to the Mediterranean people of the Neolithic period. They seem to have lived, in

prehistoric times, in most parts of Italy. They were akin to the Siculi who inhabited Sicily at a later date. Soon, besides polished stone, copper utensils make their appearance, and we reach the Aeneolithic period, or Age of Copper. In addition to artifacts in stone, copper, and bone, this period produced painted pottery of definite artistic merit. Religious practices are further developed; the inhabitants of the peninsula foster trade and begin mining. The decorative arts make progress, and the plastic arts are introduced. Most archaeologists believe that the ethnic groups of the Neolithic period were still present. The well-known Italian historian Gaetano De Sanctis, on the other hand, assigns the beginning of the Aeneolithic period to the influx of an Indo-European-speaking people, the Italici. (See also *ARCHAEOLOGY*; *MAN, PREHISTORIC RACES OF*; *NEOLITHIC PERIOD*; *PALEOLITHIC PERIOD*; *STONE AGE*.)

During the Aeneolithic period, pile-built lake dwellings called palafitte appeared in northern Italy. They continued to be used through the Bronze Age, though in this period the analogous terramare (pile dwellings found in mounds of marl on swampy land) gained in importance. Although they are derived from the palafitte, they show far greater development and are found grouped in size and numbers which indicate embryonic cities. (See also *BRONZE AGE*; *LAKE DWELLINGS*.)

Palafitte and terramare dwellers practiced agriculture and molded new types of pottery. The terramare people cremated their dead instead of burying them as had the previous inhabitants. Both groups are generally identified with the Italici, but De Sanctis believes them Etruscans.

The Iron Age is represented in Italy by various groups of remains. Those of the Villanova civilization (named for a locality near Bologna where a typical burying vault was discovered) are particularly important. They are related to the Hallstatt civilization north of the Alps (see *HALLSTATT EPOCH*). Traces of the Villanova civilization are found in Emilia, Tuscany, and Umbria; they can be divided into four periods extending from around 1000 B.C. to 600 B.C., or into historic times. The Villanova people, as well as the other inhabitants of northern Italy, practiced cremation during the Iron Age; other groups south of the Piceno River buried their dead. According to general opinion, the Villanovans may have been the ancestors of the Umbrians and represented a second great invasion of Italic-speaking people from north of the Alps, but again De Sanctis dissents. He insists that the Villanovans, because of their affinity with the terramare dwellers, were Etruscans. According to the more generally accepted theory, however, the Etruscans came originally from Asia Minor and landed in small, warlike groups on the Tuscan coast between the 10th and 8th centuries B.C. They proceeded inland and gradually moved north. Greek colonization began in Sicily around the middle of the 8th century (the traditional date is 735 B.C.), displacing earlier Phoenician trading posts on the island. Other Greek colonies were established in southern Italy, which came to be called Magna Graecia (q.v.). Syracuse (modern Siracusa) in Sicily and Taranto in Apulia were the principal Greek cities. Phoenician traders reached Sardinia in the 8th century B.C., and the Phoenician colony of Carthage inherited their

trading posts on the island. In the 6th century B.C., the Carthaginians gained possession of the south coast of Sicily. See also CARTHAGE; ETRURIA; PHOENICIA.

The Greek-Etruscan Age.—By the mid-7th century B.C., the ethnic pattern had achieved a certain stability. In the northwest (present day Piedmont, Liguria, and Tuscany north of the Arno) were the Ligures; in Venetia, the Veneti, an Illyrian people. Between the two groups were the Umbrians, representatives of the Osco-Umbrian branch of the Italic-speaking peoples; they extended from north of the Po River down to the Arno. The Etruscans lived between the Arno and the Tiber. East and south of the Tiber, we find first the Sabines, who spoke a language belonging to the Sabellian branch of the Italic subfamily, and then the Latins, chief representatives of the Latinian branch. Around the Apennine region of Abruzzi were other Sabellian peoples, among whom the Samnites played a leading role. From southern Latium to the end of the peninsula lived other Osco-Umbrian and Sabellian-speaking peoples—Volsci, Aurunci, Campanians, Lucanians, and Brutii. The Iapyges (Iapygii or Iapygians), another Illyrian people, inhabited southeastern Italy. The coasts of southern Italy and Sicily were populated by Greek colonies. The Phoenicians, and later the Carthaginians, had settled on the southwest coast of Sicily, while the aboriginal Sicani and the Siculi still held the central part of the island. (See also ITALIC LANGUAGES and separate articles on the various peoples.)

The predominant civilizations in the 7th century B.C. were Greek and Etruscan. The civilization of the Siceliots and Italiotes, as the descendants of the Greek colonizers in Sicily and Magna Graecia were called, was similar to that of Greece. The basic political unit was the polis, or city-state; when larger states were organized, they were always federations of cities. The Italiote and Siceliote city-states were established after the monarchial period of Greek history and never had kings. There was a landed aristocracy which generally remained in power until the mid-6th century B.C., when it was challenged by a plutocratic nobility. Sharply divided social classes developed, and commoners fought the aristocracy for legal equality and political influence. As in Greece itself, this struggle favored the rise of tyrants. Greek art, letters, philosophy, and science flourished almost as much among the Italiotes and Siceliots as they did in the homeland. Greek civilization spread to the Etruscans and the Italic-speaking peoples, though its influence was not fundamental. Both groups, and particularly the Etruscans, assimilated external and technical elements far more readily than they did spiritual elements.

In Etruria also the city was the basis of social life. Etruscan cities were governed by kings, appointed for a stated period or for life, and assisted by aristocratic chieftains called lucumones. The cities were grouped in federations, but the bond was a very loose one. The chief of these federations was the league of 12 cities of Etruria proper.

In the case of the Italici, political grouping into cities was far less frequent than among the Etruscans. Groups of villages and rural leagues predominated. In contrast to the Etruscans, businessmen and plain dwellers, the Italici were small farmers and mountaineers.

The Etruscans achieved a great commercial, colonial, maritime, and territorial expansion in the 7th century B.C. From the Po Valley, which they had colonized intensively, they reached down to Campania. Their expansion caused disagreements with both the Greeks and the Latins. The latter united to fight them, and between the end of the 6th century and the middle of the 5th century, Etruscan supremacy declined. The Italic-speaking peoples were able to take greater advantage of this circumstance than the Greeks, who were divided among themselves. Syracuse, which already dominated Sicily and aspired to a leading position in Magna Graecia, came into conflict with the Italiotes, and its tyrant, Dionysius the Elder (r. 405–367 B.C.), formed a temporary alliance with the Lucanians against them. The Campanians, Lucanians, and Brutii were thus able to extend their territory in southern Italy at the expense of the Greeks. In the north, the Gauls descended from beyond the Alps in the 5th century, conquered the Etruscan cities in the Po Valley, and then penetrated central Italy. (See CELTIC PEOPLES; GAUL.) Toward the middle of the 4th century B.C., Rome began to predominate.

ROMAN ITALY

The Roman era of Italian history may be divided into four main periods: (1) the unification of the peninsula, ending in 272 B.C.; (2) expansion into the Mediterranean, up to the conquest of Greece (146 B.C.); (3) the century of social and political crisis and civil war ending with the Battle of Actium (31 B.C.); (4) the empire, to 476 A.D.

Unification Under Rome.—The pre-eminence of Rome was due to the continuity of a capable governing class and to a geographical position that favored commercial expansion. From obscure beginnings, the city gradually increased its power and, during the 5th century B.C., became supreme in Latium. In 390, the Gauls attacked Rome and burned the city, but they were bought off and the raid proved to be only a momentary setback. A tenacious rival was the Samnite confederation, but because of superior political organization, Rome defeated it in a series of three wars (343–341, 326–304, and 298–290 B.C.), and also overcame the Etruscans, Latins, Umbrians, Campanians, and Gauls, who had failed to unite their forces against her. The subjection of the Italic peoples was followed by the defeat of the Italiotes in the Tarentine War (281–272 B.C.), despite the aid that they received from Pyrrhus, king of Epirus. As a result all of peninsular Italy south of the Pisa-Rimini line was brought under Roman rule. (See also PYRRHUS; SAMNITES.)

Part of the conquered territory was organized into municipalities, which retained a certain amount of administrative autonomy, or made into colonies—that is, given to Roman citizens who had settled there. (Some of these Romans kept their citizenship in their new homes; others retained only private rights.) Far wider was the territory of the so-called federated states, which renounced an independent foreign policy and bound themselves to fight for Rome by furnishing military contingents.

The Roman-Italic federation paved the way for Italian national unity. To the military and political bonds were added intermarriage, commerce, and the spread of the Latin language

and Roman civilization, which in its turn had been influenced by that of Greece.

Mediterranean Expansion and Cultural Change.—The period of Italian unification was followed by a period of conquest in the Mediterranean, which began with the First Punic War (264–241 B.C.). In the course of this war, the greater part of Sicily was conquered and became, in 241, the first Roman province. Sardinia was acquired in 238, Corsica around 230, and the whole of Sicily in 211. (Meanwhile, in 222, the Gauls in northern Italy were decisively defeated, and Roman colonies were extended to the Alps. By 191, Cisalpine Gaul had become a Roman province.) By 201, the greater part of the Iberian peninsula had been conquered; it was organized into two provinces in 197. (All except the extreme northwest portion was acquired by 133 B.C.) Greece was acquired at the conclusion of the Macedonian Wars (215–206, 200–196, 171–167, 149–148 B.C.). In 146 B.C., the year in which Greece was reduced to provincial status, the Third Punic War was brought to a conclusion with the destruction of Carthage. The Mediterranean had become a Roman sea. (See also GREECE—*Ancient History and Culture*; PUNIC WARS.)

The initiative and political conduct of these wars were purely Roman; the other states and peoples merely contributed troops. Moreover, the provinces formed of the conquered territory belonged only to the Roman state. Yet the commercial and demographic expansion around the Mediterranean was an Italian as well as a Roman undertaking. The conquest of Cisalpine Gaul was accompanied by the declaration that all territory lying south of the Alps was *ager populi romani* (land of the Roman people). This was a fundamental step in the identification of geographical with political Italy. The transformation of Roman-Italian society accelerated the process of unification.

Until the period of expansion this society had consisted mainly of small farmers who lived a simple and traditional life. The neglect of agriculture during a period of continuous war and the competition of imports from the newly acquired provinces ruined the small owners of the peninsula, and their land was acquired by capitalists and war profiteers. Italian merchant fleets sailed east, competing with the Greek and Asiatic fleets. In agriculture, the transition from small to large ownership brought about the introduction of vineyards and olive groves beside the wheat fields. The economic and social transformation was accompanied by cultural changes. A Roman or Latin literature developed, influenced by Greek literature, but retaining its own character. The major writers were non-Romans from various parts of Italy. The development of Latin literature intensified the spread of Greek culture throughout Italy and helped create a new spiritual unity. Rationalism, individualism, and skepticism took hold of men's minds, undermining the strong but primitive Roman civic sense.

Social and Political Crisis and Civil War.—The agrarian problem which had developed during the period of expansion became acute toward the end of the 2d century B.C. The impoverished middle class demanded part of the public land that had been given to, or had been taken over by, the large landowners. The first effective agrarian laws were enacted. They were spon-

sored by two tribunes, the brothers Tiberius Sempronius and Gaius Sempronius Gracchus (q.v.), who served in 133 and 123–122 B.C., respectively. Both were defeated in armed strife with the nobility, but their program remained in part. Social problems were interwoven with the political claims of the Italians, who demanded Roman citizenship. The Italians of Osco-Sabellian descent broke their allegiance to Rome under the pressure of economic difficulties, organized an independent federal state, and set up a capital at Corfinium on the Pescara River. They were defeated in the Social War (90–88 B.C.), but Roman citizenship was then extended to all the Italian peoples, and later to all the inhabitants of Italy.

Nevertheless, Rome remained a city-state, not the capital of a national state. This structural defect was remedied in part by the municipalization of Italy, so that the Roman state came to consist of a network of city-states, locally autonomous but directed politically by the government in Rome.

The organization of Italy into municipalities coincided with the period of bitterest internal unrest, with rival groups fighting for power and for social and economic changes. The victorious faction would confiscate the land owned by the losers and distribute it among its own supporters, first choice being given to the soldiers. The army underwent a radical transformation. The earlier casual and unpaid assemblage of well-to-do citizens became a permanent and salaried force made up mostly of poor men, who were given grants of land upon their retirement. It was a potent instrument in the hands of leaders who had as their aim the end of the republic.

The civil wars aligned the *optimates* (the aristocratic-conservative faction) against the *populares* (the democratic-revolutionary party). The former were victorious with Lucius Cornelius Sulla against Gaius Marius and his son and namesake (88–81 B.C.); the latter, with Gaius Julius Caesar against Pompey (Gnaeus Pompeius Magnus) and his sons (49–45 B.C.). This second civil war established Caesar as dictator, at first for 10 years (46), and then for life (44). In March 44, however, he was assassinated, and a third civil war began between those responsible for his death (Decimus Junius Brutus, Marcus Junius Brutus, Gaius Longinus Cassius) and the heirs of his power and program: Mark Antony, Octavius (Caesar's adopted son), and Marcus Aemilius Lepidus, who formed a triumvirate in 43 B.C. In the following year, Mark Antony and Octavius defeated their opponents in the Battle of Philippi (q.v.), but were to fight each other in the fourth and last civil war, which ended with Octavius' victory in the Battle of Actium (q.v.), on Sept. 2, 31 B.C. This date marks the end of the republic and the beginning of the empire. Four years later, Octavius was given the title of Augustus by the Senate. See also biographies of the leading figures.

The Empire.—The advent of the empire made a national life for Italy impossible. From the city-state we pass to the universal state, governed formally by a diarchy (Senate and emperor), but substantially by an absolute monarchy. At its inception, the empire already extended from the Atlantic to the Rhine, and in Asia to the Euphrates, and included the greater part of the north coast of Africa. A provincial nobility grew in size and power beside the Italian

nobility. After some resistance on the part of the Romans and Italians, Roman citizenship was extended to many classes of provincials, and in 212 A.D., all free inhabitants, with a few exceptions, were made citizens by the Emperor Caracalla. Italy's economic prosperity, which was at its height at the time of the death of Augustus (14 A.D.), began to decline at the end of the 1st century following the economic revival of the eastern provinces and the development of Gaul and Spain.

The concentration of landed property in the hands of a restricted class of agrarian nobles was accentuated during the 2d century A.D. to the detriment of small farmers and city dwellers. Under the Antonine emperors (Antoninus Pius, r. 138-161, and Marcus Aurelius Antoninus, r. 161-180), Italy's population had already decreased. Industry and commerce declined in Italy in the 2d century, while they flourished in the provinces. Italian merchants were no longer established in the East, while a rapidly growing number of Orientals were found in the West.

The economic depression brought about a decadence of municipal government in Italy. As early as the 2d century, interference by the central government had become more frequent and extensive. Even more rapid was the elimination of the Roman-Italian element from the army. During the 3d century, the soldiers—by then almost entirely provincials or barbarians—wielded all power and made up the greater part of the civil service. This meant that Italians had lost almost all influence in government. The growing despotism of the militaristic monarchy, and the anarchy caused by the competition of the aspirants to the throne put forth by the various armies, resulted in the disappearance of city autonomy. The empire, which had attained the height of its territorial extent and power under Trajan (r. 98-117) and Hadrian (r. 117-138), was diminished by barbarian encroachments.

The temporary restoration of imperial prestige and power which took place during the reigns of Diocletian (r. 284-305) and Constantine I (r. 306-337) represented the definitive transformation of the imperial republic into an absolutistic, bureaucratic monarchy with a marked theocratic and Oriental character. Italy's distinctive personality within the empire vanished, and she became completely identified with the provinces.

The reign of Diocletian also saw the first division of the empire into eastern and western sections. Although Constantine reunited it in 330, it was again divided in 364, and after a temporary reunion (388-395 A.D.) under Theodosius I, it was permanently divided at his death into the Western Roman Empire and the Eastern Roman or Byzantine Empire with its capital at Constantinople.

In the 4th century the major part of surviving Roman vitality was found in the Catholic Church, which was granted legal status by Constantine's Edict of Milan in 313 A.D., and became the state church under Theodosius (r. 379-395). Bishops acquired great civic importance. The bishop of Rome not only claimed honorary primacy among them, but also effective supremacy in the direction of the church as the successor of St. Peter. Rome won in the religious sphere the importance which she was losing politically.

Early in the 5th century the barbarians, who had already invaded the provinces, attacked

Italy. In 402, a Visigoth army led by Alaric was defeated at Pollentia, and in 405 or 406 an army of Alani and other tribes was beaten by Flavius Stilicho at Florence. In 408, Alaric again invaded Italy and two years later sacked Rome. Attila invaded northern Italy in 452, and, in 455, Rome was again sacked, this time by the Vandals under Genseric. In that year, Valentinian III, last of the Theodosian emperors to rule in the West, died. The last two decades of the Western Roman Empire present a rapid succession of impotent emperors (nine in all) dominated by barbarian generals, while some influence was exerted in Italy by the emperor in Constantinople. Finally, in 476 A.D., the barbarian soldiers stationed in Italy, in order to obtain land grants similar to those that had been given to soldiers outside the peninsula, deposed Romulus Augustulus, last Western emperor, and placed one of their own captains, Odoacer (Odoavac or Odovakar), on the throne.

See also ALANI; ATTILA; GOTHs; ROME—*History of Rome, City and State*; VANDALS.

THE EARLY MIDDLE AGES

With the disintegration of the Western Roman Empire, Italy gradually reassumed a distinctive character. By 476, the empire had been reduced to approximately the territory of Italy. As a result, the terms Roman and Italian were once more identical, as they had been in the late republican period. This did not mean, however, that the Romans had been absorbed by the Italians. Rather it meant that the Italians were Romans—that is, citizens of the empire, or the republic, as it was still called. Italy was still considered part of the empire, not only by the Romans, but also by the barbarian conquerors. Odoacer and his successor Theodoric were legally, and intended to remain, vicars of the Byzantine emperor in Constantinople. The secession which took place in Gaul and Spain, and which was followed by the fusion of the Roman population and the Germanic invaders, giving birth to new nations, did not occur in Italy.

Barbarian Rule and Byzantine Reconquest.

—Odoacer was vanquished and killed (493) by Theodoric, king of the Ostrogoths, who were federated with the Eastern Roman Empire. Under both rulers, Roman civil administration remained untouched and was carried on by Romans, according to Roman law, with the participation, under Theodoric, of Gothic elements in both central and local government.

Among the Roman nobility (the large land-owning class) a pro-Byzantine tendency persisted, partly because the Ostrogoths were Arians. (See ARIANISM.) It became more marked towards the end of Theodoric's reign (526). The Romans took sides with the empire when Justinian I (r. 527-565) undertook to reconquer Italy. The Gothic War (535-555), conducted by his generals Belisarius (to 548) and Narses, brought about the destruction of the Goths and the devastation of Italy, which thereafter became a Roman province governed from Constantinople.

Because of the state of war caused by the invasion of the Lombards (q.v.) in 568, executive power was vested in the commander in chief of the imperial armies, who served as exarch, or imperial vicar, and had his seat in Ravenna. He was assisted by duces, who held the command of troops in the various districts.

By this time the last remnants of municipal government had disappeared, with the exception of a few cities such as Ravenna and Naples, and city councils had been disbanded. The Roman Senate, which had already been decimated by the Goths during the Gothic War, now disappeared. Now more than ever the bishop became the most important citizen, especially since the churches were among the largest landowners. In this period, large landownership was extremely important. As the cities declined, the courts within large estates became the centers of economic life.

The imperial reconquest tightened the bonds between Italy and Byzantium, particularly in the religious and cultural fields, spreading Byzantine art. The native element reacted by resisting Justinian's interference in ecclesiastical affairs in the Three Chapters schism (see *VIGILIUS*), and by organizing at the abbey of Monte Cassino, Benedictine monastic life, which differed widely from that of Eastern monasteries. The Benedictines gained more ground in other parts of western Europe, however, than they did in Italy.

Lombard Invasion and the Division of Italy.—The Byzantine Empire was unable to provide for the defense of Italy, which in 568 was invaded by the Lombards under Alboin. The Lombards did not succeed, despite repeated attempts, in conquering all of the peninsula. Its territorial and political organization was consequently split between a Lombard state ruled from Pavia and the Byzantine province with its capital at Ravenna. Neither state was clearly defined, and they were in turn divided into a great many fragments which were only weakly united. These conditions, and the weakness of the central power, contributed to the development of regionalism, which became characteristic of Italy into modern times.

The Lombard state was headed by a king elected by an assembly of freemen, which was identified with the army. The principle of dynastic continuity had a strong influence in the election. The assembly assisted the king in enacting laws and in making major decisions. Lombard territory was divided into duchies instead of provinces, and these in most cases were based on the administrative districts of the cities. Some border duchies, however, comprised entire provinces. The most important of these were Benevento (q.v.) and Spoleto. The duke was a state official, but he actually enjoyed considerable autonomy and in many cases the succession became hereditary. The weakness of royal power in dealing with the dukes was the principal cause of the fall of the Lombard kingdom. The duchies of Spoleto and Benevento, in particular, almost constituted independent states.

The Romans or Italians were treated at first as tribute-paying half-freemen. Their position gradually improved, however. They came closer to the Lombards, and a process of absorption began, especially after the conversion of the Arian or pagan Lombards to Catholicism. This took place in the late 7th century after a treaty based on the status quo had been negotiated between the Lombard kingdom and the Eastern Empire, in 681.

The division of Byzantine Italy favored the development of local autonomy under the direction of large landowners. The landowners headed local military organizations, which became very important. Among the chief causes of friction between the Roman-Italian people and the Byzan-

tine conquerors were the repeated religious quarrels between Rome and Constantinople, brought about by the emperor's persistent interference in ecclesiastical affairs. The Italian population took the part of the bishop of Rome, or pope, as he had come to be called.

In Rome, the pope gained in power and political influence. Assisted by a number of ecclesiastical and lay councilors, he predominated not only through ecclesiastical primacy, but also through extensive landownership and religious ascendancy as the successor of St. Peter. The devotion to St. Peter, widespread among the peoples of western Europe, was a potent factor in increasing the pope's influence and in maintaining the universal importance of Rome.

A special and singularly fortunate instance of the development of local government under the suzerainty of the empire was the case of Venice—that is, of the inhabitants of Venetia who had fled from the mainland to the lagoon during the invasions and had succeeded in exploiting the natural resources of their new home by trading in fish and salt. In 697, they substituted a doge for the earlier government by tribunes.

Temporal Power and the Carolingian Empire.—A serious conflict between the papacy and the Italians on the one hand, and the Byzantine Empire on the other, developed in the first half of the 8th century. It came about partly because of political and economic factors, but more especially because Emperor Leo III (called the Isaurian, r. 717–741) had determined to abolish the worship of images (see *ICONOCLAST*). There was a general rebellion in central Italy, and the Lombard king, Liutprand (r. 712–744), intervened with the intention of eliminating the empire and extending Lombard dominion in Italy. In 728, he captured Ravenna, and later defeated the dukes of Benevento and Spoleto. Pope Gregory II excommunicated the iconoclasts in 731.

With the iconoclastic threat removed, the popes turned to the Frankish kingdom for assistance against the Lombards, availing themselves of the great devotion to St. Peter existing among the Franks and the new Carolingian (Carlovingian) dynasty. The king of the Franks, Pepin (r. 751–768), invaded Italy and subdued the Lombard king Aistulf (r. 749–756), who was threatening Rome, and, in 755, compelled him to turn over the cities he had occupied to Pope Stephen II. The donation of Pepin, as the conquered territory was called, included the Roman duchy, the former Exarchate of Ravenna, and the Pentapolis (the Adriatic cities of Ancona, Fano, Pesaro, Rimini, and Senigallia). It formed the basis of the subsequent temporal power of the papacy. The pope made Pepin patrician of Rome. When King Desiderius (r. 756–774) threatened a new Lombard expansion, Pepin's son Charlemagne (Charles the Great, r. 768–814) invaded Italy, dispossessed the king, and appointed himself king of Lombardy, in 773. In the following year, Charlemagne confirmed Pepin's donation to the pope. The name Kingdom of Italy came into use, replacing that of Kingdom of Lombardy.

The Franks governed the conquered territory in collaboration with the Lombards. They replaced the dukes with counts and established margraves in the larger border states. Franks and Lombards continued to use their own laws, while the Italians and Romans followed Roman

law. In central Italy, the Duchy of Spoleto continued to exist as part of the Italian kingdom. The papal domains were under the suzerainty of Charlemagne, who was, like his father, given the title of patrician of Rome. Meanwhile in southern Italy the dukes of Benevento took the title of princes of the Lombards and wavered between Frankish and Byzantine sovereignty. The principalities of Salerno and Capua later separated from Benevento, while the Duchy of Naples remained Byzantine but had an autonomous government. Sicily and Calabria were directly subject to Constantinople. The general picture shows an increase in the number of Italian subdivisions and local distinctions. After 827 the Saracens, who had settled in Sicily, extended their control in southern Italy, even, as in 846, attempting raids on Rome. (The Saracen conquest of Sicily was completed in 878.)

On Christmas Day in the year 800, on the initiative of Pope Leo III, Charlemagne was crowned emperor of the Romans in Rome. A dual conflict was to result, first between emperor and pope, then between Frankish and Byzantine empires. The Frankish empire itself was divided among Charlemagne's three grandsons in 843 by the Treaty of Verdun. (See also CAROLINGIANS; CHARLEMAGNE; CHURCH STATES; FRANCE—27. *History*.)

In the Carolingian period, the Kingdom of Italy was at times governed by a king as imperial vicar, and at times by a king-emperor. Royal-imperial authority was fairly effective until the death of Emperor Louis II (r. 855-875). The quarrels between the French and German Carolingians marked the beginning of the disintegration of imperial power, and the process was accelerated after the deposition of Emperor Charles III (called the Fat), in 887. In this period, feudalism reached its fullest development in Italy. Local lords became masters of their territory. Repeatedly the Italian crown became a bone of contention among warring pretenders who followed one another in rapid succession. In Rome, the local aristocracy gained control early in the 10th century. Power was concentrated in the hands of Theodora, wife of a senator, and her daughter Marozia, who married a Lombard adventurer, Alberic I. This period, called the pornocracy, or rule of profligate women, was brought to a close by Alberic II (r. 932-954), an able ruler who was made prince and senator of the Romans.

In the same period, we find another energetic sovereign in Hugh, count of Arles, who was king of Italy from 926 to 947, ruling jointly with his son, Lothair II, after 931. Hugh was defeated in 945 by Berengar II (r. 950-961), who, in his turn, was first made a vassal and then entirely dispossessed by Otto I, king of Germany (r. 936-973). In 962, Otto was crowned emperor in Rome.

FROM THE ESTABLISHMENT OF THE HOLY ROMAN EMPIRE TO THE COUNTER REFORMATION

The six centuries extending from the coronation of Otto to the Treaty of Cateau-Cambrésis may be divided into three major periods. The first, in which the German emperors, the popes, and the rising Italian cities vied for power, lasted until the early 14th century. It was followed by a 150-year period in which the various Italian principalities at first contended with each other and then reached a state of

equilibrium. The third period extended from the French invasion in 1494 to the final establishment of Spanish hegemony in the peninsula in 1559.

The Holy Roman Empire.—The union of the crowns of Germany and Italy with the imperial crown in 962 marked the effective beginning of the Holy Roman Empire of the German Nation.* The elected king of Germany was at once king of Italy and emperor. Although the two kingdoms remained separate, northern and central Italy became an appendage of Germany, and Germans were added to the Lombards and Franks in the Italian governing nobility. In the south, however, an attempt made in 982 to expel the Saracens failed.

Under the first three emperors of the house of Saxony—Otto I (r. 962-973), Otto II (r. 973-983), and Otto III (r. 983-1002)—The Kingdom of Italy remained in quiet subjection to the empire. Rome, in contrast, showed repeated hostility to the emperors and the popes appointed by their orders. Under the last Saxon, Henry II (r. 1002-1024), an anti-German party gained ground in northern Italy as well, and proclaimed Ardoïn (Arduin), marquis of Ivrea, king in 1002. His success was short-lived, however, and he was deposed by Henry in 1014.

The first two emperors of the Franconian or Salian dynasty, Conrad II (r. 1024-1039) and Henry III (r. 1039-1056), encountered far greater difficulty than had the Saxons in governing northern Italy. This was particularly true of Milan, where the middle-class citizens, at first in agreement with their bishop and later in opposition to him, showed an independent spirit. In the south, Norman chieftains, who had taken part in local quarrels between Lombard princes and citizens of Apulia and the Byzantine governors, gradually acquired power and defeated expeditions sent by the emperors against them.

In Rome, the papacy, which, after the reign of the Ottos, was once more controlled by the local aristocracy, had lost most of its prestige. In 1046, Emperor Henry III intervened and nominated Clement II, the first of a series of German popes. With Henry's support, Clement and his successors inaugurated reforms for which the religious orders and many leading persons had appealed. In particular, the reform movement fought simony and clerical marriage.

Under Henry IV (r. 1056-1106), the struggle against simony was transformed into a fight against the royal privilege of conferring investitures upon high church officials, a privilege which gave the emperor control over church affairs. In 1075, Pope Gregory VII (Hildebrand, r. 1073-1085) issued a decree against lay investitures. He excommunicated Henry, who, however, by presenting himself at Canossa, was absolved. In 1084, Henry deposed Gregory and was crowned by the antipope Clement III. The investiture question was finally settled in 1122 by the Concordat of Worms, concluded between Emperor Henry V (r. 1106-1125) and Pope Calixtus II (r. 1119-1124). The concordat was a compromise, providing for different methods of episcopal appointment in Germany and Italy. See also GERMANY—3. *History*; HOLY ROMAN EMPIRE.

The Two Sicilies and the Communes.—During the struggle between the empire and the

* Actually, the designation holy was not used until after 1155, when Frederick I was crowned emperor.

papacy, important changes were taking place in Italy. Southern Italy passed entirely under the domination of the Norman brothers, Robert Guiscard and Roger I of Hauteville. In 1059, the reformist papacy, in order to gain support against the Roman nobility and the emperor, recognized Robert Guiscard as duke of Apulia and Calabria. With the capture of Bari in 1071, he eliminated the last seat of Byzantine power in Italy. Meanwhile, the brothers had begun the conquest of Sicily from the Saracens, and, in 1071, Roger became count of the island. Count Roger II (r. 1105–1154) assumed the title of grand count, and, in 1130, having inherited the Duchy of Calabria and Apulia from his cousin William, united the Norman domains on both sides of the Strait of Messina and was crowned king of the Two Sicilies. In this way, the entire south was united into a single kingdom, which was subtracted from the Byzantine Empire and placed under papal suzerainty. (See also SICILIES, KINGDOM OF THE TWO.)

An entirely different development was occurring in northern Italy, with the growth of a number of separate republics, the communes. Despite the disappearance of the Roman municipalities in the 6th century, the cities had preserved an individual life and character, not only as centers of population, but also as episcopal sees and as administrative headquarters of dukes and counts. The development of courts on the estates had hurt them economically, and even more injurious was the growth of feudalism, which concentrated power in the hands of the lords, who lived on their estates, and so deprived the cities of political influence. The city dwellers became to a certain extent the vassals of the feudal lords. Nevertheless, the importance of city bishoprics remained and it grew with the extension of episcopal power, particularly under the Ottos. In greater or less degree, the sovereign privileges of the bishops placed them in charge of the actual government of their cities. Because of the press of ecclesiastical duties, they delegated a good deal of administrative power to lay citizens. After about 850, the cities of northern Italy began to display a certain independence of their bishops, as well as of the feudal lords.

The principal cause of the revival of communal spirit was the development of economic life, and particularly of trade, with a concomitant increase of urban population. Economic revival became general in the 11th century and was intensified in the 12th, partly as a result of the Crusades. Italy, particularly Venice and the Po Valley, became the clearinghouse for trade between the East and central Europe. Currency changed hands in unprecedented amounts, causing a decline in the value of landed property and also facilitating its exchange. Traders and artisans organized *arti*, or guilds, uniting the members of each profession within a city. They exercised a monopoly over the economic life of the cities, and also offered their members protection and social security. The associations of traders, organized in Italy before those of other European countries, became instruments for co-operative investment and the sharing of profits. Out of them developed a number of supplementary business enterprises, including storage facilities, banks, clearinghouses, commercial papers, and the establishment of branches. Together with the merchants and artisans, the small

landowners gained in importance. Some were *secondi militi*, or minor nobles, who, while owning small landed estates, lived in town in order to take an active part in industry or commerce.

Out of the free association of these craft and trade guilds, at different times and in different ways, the communes came into being. The commune originated as a private organization, but gradually came to take over part of the administration of the city and so evolved into a public body. It did not at first try to supersede the authority of the bishops or feudal lords, but existed beside them and in active competition with them, limiting and combating their interference by organizing a growing number of individuals and public activities and by endeavoring to bring all the inhabitants of the city and its adjoining territories under its own leadership. In the commune, the Italian people acquired a distinctive and autonomous personality; after centuries they were once more a subject and not an object of history.

Although the communes upheld their authority against alleged ecclesiastical and feudal rights, they did not strive for complete autonomy, or for what we might term state sovereignty or independence from superior authority. The Italian communes recognized the sovereignty of the emperor and king of Italy. We might even say that the communes replaced the great feudal lords in their relationship with the sovereign. In fact, once they had reached maturity, the autonomy of the communes in ordinary times appears to have been complete.

In the first communes, a minority of citizens distinguished by birth, social position, or wealth took charge of the government. The *popolo grasso* (big people), as they came to be called, were mostly minor nobles and rich burghers who rapidly formed a new aristocracy which, besides possessing ready money, had acquired land, thus taking the place of the ancient nobility. Later, the minor artisans and dependents of the larger guilds—the so-called *popolo minuto* (little people)—grew in importance. The contest between the two groups for participation in city government took place through the guilds. Alongside the craft guilds or *arti* were the *societates armorum*, or armed companies, militia based mainly on the sectional divisions of the city, in each of which citizens were organized by a leader for the maintenance of public order and for defense against attack from outside the city.

The supreme governing body in the commune was the assembly of all citizens enjoying political rights: it was called *parlamento*, *concione*, or *arengo*. The assembly elected magistrates and passed on city bylaws, declarations of war, and peace treaties. More restricted bodies, such as the *consiglio di credenza* (fiduciary council), assisted the city magistrates in an advisory capacity. The magistrates were the administrative and judicial executives, and they commanded the city militia in time of war. In most cities they came to be called consuls, probably in imitation of Rome, because the memories of ancient Rome and the consciousness of being its descendants were characteristic elements of the renewed Italian national sense and of the civic pride of the communes. Consuls existed in Pavia in 1084, and in Milan in 1097.

Communal development in northern Italy generally preceded that in central and southern Italy.

Florence had its first consuls in 1138, while in Lucca they had appeared shortly after 1080. Development was even more precocious in the maritime cities of Pisa and Genoa (c. 1000). Venice continued her uninterrupted autonomous development without passing through a feudal period. The old real estate-owning aristocracy was gradually replaced by wealthy merchants. The head of the state was the doge, at first elected and later appointed for life. His power, however, was gradually superseded by the growing influence of the aristocracy.

The commercial expansion of Venice took place mainly in the eastern Mediterranean, through trade with the Byzantine Empire and the Moslems, and later with the Kingdom of Jerusalem and other states founded by the Crusaders. This expansion went hand in hand with the republic's growing naval power and territorial acquisitions. Venice endeavored to dominate the Adriatic and defend it against the Slavic people and the Saracens. To this end, she colonized the coasts of Istria and Dalmatia.

The maritime cities of Campania—Naples and Amalfi—had a similar development, though on a far smaller scale than that of Venice. However, they lost their autonomy after the Norman conquest, a fate which also befell other southern cities, particularly in Apulia, where communal organizations were already well under way. See also CRUSADES; GUILD; and articles on individual cities.

Conflict Between Communes and Empire; the House of Anjou.—Until the middle of the 12th century the communes encountered little opposition from the empire, which was occupied with dynastic struggles. They did not, therefore, feel the necessity of forming defensive leagues and concentrated on local expansion, which resulted in almost constant conflicts between one city and another. The cities formed counterbalancing alliances for war or for the maintenance of peace.

Emperor Frederick I (called Frederick Barbarossa, r. 1152–1190) of the house of Hohenstaufen or Swabia, having consolidated his power in Germany, resumed, in 1154, the program of the Ottos for the conquest of Italy. In all, he made six expeditions to the peninsula, coming into conflict with the communes in the north, with the papacy in the center, and with the Norman kings—William I (r. 1154–1166) and William II (r. 1166–1189)—in the south. In 1167, the communes formed the Lombard League, which entered into alliance with Pope Alexander III (r. 1159–1181) and William II. Frederick was defeated by the league's army at Legnano, on May 29, 1176. In the following year, he detached the pope from the league by the Treaty of Venice, and in 1183, came to an agreement with the communes at Konstanz (Constance), recognizing their right to local autonomy, but preserving imperial sovereignty. The league was dissolved and lost the opportunity of forming a permanent confederation, as the Swiss cantons were to do in 1291. In the south, the Hohenstaufen dynasty not only made peace but contracted a matrimonial alliance with the Normans. In 1186, Constance of Sicily, heiress of William II, married Frederick's son, Henry VI, who became emperor in 1190 and king of the Two Sicilies in 1194, after he had overcome the forces of King Tancred (r. 1190–1194).

After Henry's early death, in 1197, two contenders—Philip of Swabia (r. 1198–1208; never crowned), leader of the Waiblingen party, and

Otto IV of Brunswick (r. 1198–1218; crowned 1209), leader of the Welfs—fought for the imperial crown, and the power of the empire consequently declined. The communes of central Italy were able to take advantage of this situation, and so was Pope Innocent III (r. 1198–1216), who began by favoring Otto and later negotiated with Philip. Innocent was an active politician who aspired to the temporal leadership of the Christian world. He recovered a certain amount of power in Rome, where a commune had been formed in 1143–1144, and renewed papal sovereignty over Umbria and Marche.

In 1210, Innocent excommunicated Otto IV, and in 1212 he secured the election of the son of Henry VI, Frederick II (r. 1212–1250), who had been king of the Two Sicilies since 1198. Exploiting the resources of Sicily, which was ruled by a centralized, despotic government, he attempted to dominate Italy, only to come into conflict with the papacy in 1227, when he was excommunicated. (He was excommunicated for a second time in 1239, and again in 1245.) The Italian cities took sides for or against the empire. The former were Ghibelline (Ital. *Ghibellino*, a corruption of the German *Waiblingen*); the latter, Guelph or Guelf (Ital. *Guelfo*, from the German *Welf* family). (See also GUELPHS AND GIBELLINES.) The Guelphs, led first by Milan and then by Florence, gained supremacy. Frederick died excommunicate, without having triumphed over communal autonomy in northern and central Italy or over the papacy.

An illegitimate son of Frederick II, Manfred, became king of the Two Sicilies (r. 1258–1266) and leader of the Ghibellines. In the absence of imperial power, during the interregnum between Conrad IV (r. 1250–1254) and Rudolf I (r. 1273–1291), Italy's situation was in many ways reminiscent of that existing at the close of the Lombard period, and there was some possibility of finding a national solution. The popes, however, fearing Manfred's power, called Charles of Anjou, brother of King Louis IX of France, to Italy, and in 1266 he was crowned King Charles I of the Two Sicilies. Manfred was defeated and killed at Benevento in 1266, and his young nephew Conradin, the last Swabian, suffered a similar fate, at Tagliacozzo in 1268.

The dominion of the house of Anjou over the entire kingdom of the Two Sicilies was short-lived. Sicily, dissatisfied with the harsh rule of Charles I and with French customs, rebelled in the Sicilian Vespers (q.v.) in 1282, and called upon King Pedro III of Aragon for aid. The French were expelled from the island and the crown of Sicily was joined with that of Aragon. (In 1296, Frederick II, brother of James II of Aragon, became ruler of the separate Kingdom of Sicily.) The Angevins, who remained rulers of the Kingdom of Naples (in 1285, Charles was succeeded by his son Charles II, d. 1309), attempted to reunite the two Sicilies in a series of wars with the Aragonese, but were unsuccessful. (Angevin claims to Sicily were finally abandoned in 1373, by Queen Joanna I of Naples.) They had no greater success in their attempt to consolidate their dominion in Italy as leaders of the Guelphs. They played a major role, however, in thwarting the last imperial attempts to control Italy, undertaken by emperors Henry VII of Luxembourg (r. 1308–1313) and Louis IV of Bavaria (r. 1314–1347), but even in this respect the importance of Florence was greater than

theirs. See also SICILIES, KINGDOM OF THE TWO; and separate biographies of important figures.

The Signories.—At the end of the 13th century, Italy consisted of several hundred states, which included the kingdoms of Naples and Sicily and the Papal States, these in turn being broken up into a number of communes. Tuscany and Lombardy were divided into a large number of communes and a few feudal domains: The leading commune in Tuscany was Florence, followed by Pisa, Siena, and Lucca. In Lombardy, Milan was outstanding, followed by Pavia, Alessandria, Brescia, and Verona. In the west, Piedmont contained a few important feudal domains, such as the Marquisate of Monferrato and the County of Savoy (Savoia; Savoie). The counts of Savoy (dukes after 1416), however, because of their origin and their possessions beyond the Alps, were Burgundians rather than Italians. (See SAVOY, HOUSE OF.) In the east, in Friuli, the patriarch of Aquileia was predominant. In Liguria, Genoa had extended her dominion along the eastern and western Riviera, while in Venetia, Venice had not as yet begun her territorial expansion.

In 1297, with the transformation of the Gran Consiglio (Great Council) into a restricted, hereditary body, Venice became an aristocratic oligarchy. Meanwhile, transformations had taken place in other Italian cities. Around 1200, the communes, which had originated as unions of citizens, tended to break up into opposing groups. The nobles, who had played a leading role in founding the communes, gained in strength as their ranks were increased by country nobles who had come to live in town by necessity or choice, and by the rich burgher families which had attained nobility. The middle class, with its growing prosperity, built up its own organizations (*societates mercatorum*) and demanded participation in city government with its own officials (*consules mercatorum*). There were, therefore, two classes, *milites* (nobles) and *pedites* (commons), which organized and formed two states within the commune. Later, the wealthy burghers (*popolo grasso*) were challenged by the artisans (*popolo minuto*).

The original commune had been governed by a *collegio*, or assembly, which provided a form of proportional representation for the various classes and parties. As the interests of the classes drew further apart, the *collegio* became unable to function. In order to resolve this impasse, an attempt was made to substitute a single executive for the governing body—a magistrate chosen outside and above the parties, the *podestà*. (Florence had its first *podestà* after 1202.) The growing strength of the *pedites* brought about the introduction of another magistrate, the *capitano del popolo*. The *capitano* presided over the *consiglio del popolo* (people's council); the *podestà*, over the *consiglio del commune* (city council). Finally, the leaders of the principal guilds (*priori*) became city magistrates, and in some cities, among them Florence, were the most important.

Local feuds between social groups and rival families were interwoven with quarrels between cities, exiles taking refuge in rival cities, and with the general conflict between papacy and empire. They were consequently classed as Guelph or Ghibelline. Alliances of the two parties formed chains through entire regions, and even from one region to another.

Neither the institution of the *podestà* nor the

predominance of the people, which amounted to class dictatorship, sufficed to restore internal balance. A solution was sought through the *signoria*, or signory, which was a similar, but intensified and more permanent, form of government by *podestà*. Milan adopted this system in 1259. In the various cities, the *signore*, or lord, as he was called, became the head of the commune, following election by the popular assembly. Later, popular elections gave way to imperial or pontifical investiture. Republican institutions and magistrates survived for longer or shorter periods but lost both their significance and their autonomy.

The signory, in its fundamental character, in which mercenary armies played an essential part, and in its manner of functioning, was a monarchy. The people were excluded from the government and did not participate in political life. The process of development and political education which the communes had begun was destroyed for centuries to come. The monarchical character of the signory reached its full development when the office of *signore* became hereditary. Although political freedom was lost, the consolidation of the signory did insure order and impartial justice, respecting all parties and social classes. The institution of the signory hastened the grouping of minor cities around the larger centers, a process which had begun in the communal period. In this field also, the signory gave assurance of a greater degree of impartiality between the commune of the capital and those of the aggregated cities. The signory became an agglomeration of communes governed as a state by a single person. In time this personal unity evolved into a closer bond. Local autonomies were gradually replaced by uniform institutions and magistrates common to all, through which the *signore* governed and administered his state. The old elective magistrature was gradually replaced by a uniform and centralized bureaucracy. The signory, therefore, was the first step toward the development of the modern state, not only in the extension of its rule, but also in the organization of its government.

Italian Unity and Communal Civilization.—Progress in internal state unity was not accompanied by a trend toward complete external autonomy. Neither the signories nor the principalities which followed them claimed absolute independence of the empire, nor was any progress made toward national unity. The empire and the papacy were regarded as general directing principles, but they were at the same time too universal and too weak to bring about unity. Federalism, on the other hand, was not developed beyond brief, local enterprises. The number of Italian centers, the interlocking interests, and the physical nature of the country, unsuited as it was for cantonal demarcation, prevented the development of federalism and helped to maintain the fluidity of Italian political life. Italy was too uniform to permit rigid divisions, too varied to adopt a single constitution.

Nevertheless, an Italian national consciousness did exist. There was a historical unity which went beyond the specific internal problems of the various communes. There was also a unity of ethnic inheritance, of language, culture, and family life, and of economic, religious, and political affairs. A closely knit chain bound the life of each city or regional state with that of its neighbors.

This basic national unity became particularly apparent in the uniform and high civilization of

communal Italy, especially during the period from the birth of St. Francis of Assisi (1182) to the death of Dante Alighieri (1321). Italy played a leading part, on a level with, or immediately after, that of France, in the revival of European civilization in the 11th century. A product and an instrument of this revival were the universities, with which Italy rivaled France. The University of Paris held first place in theology, the University of Bologna in law. In theology and scholastic philosophy, Italy was second only to France. She made an important contribution to the Western rediscovery of Aristotle (which became all important in medieval philosophy), with the translation from the Greek texts undertaken in Sicily, and the most imposing scholastic synthesis was the work of an Italian Dominican, St. Thomas Aquinas (1225?-1274). Italy accomplished, with Bologna as its center, the resurrection of Roman law through the contribution of a long series of famous scholars. Moreover, canon law, which had papal Rome as its cradle, was studied intensively.

The 12th century saw a new flowering of Latin literature, which no longer seemed the outworn repetition of ancient formulas or the medium of rough transcriptions compiled for immediate use, but the adequate expression of a new moral and intellectual life. It prospered particularly in the historical field. Besides universal chronicles, we find a number of analytical records describing the events in the communes and in contemporary Italy in general. In these works we frequently note a vivid and even politically partial interest in the recorded events. Sometimes they attained real art, revealing the personality of the observer and writer. A masterpiece of this kind is the *Cronica* (1168-1287), by the Franciscan friar Salimbene (Ognibene di Guido d'Adamo, 1221?-1289). In the field of pure literature, Italy was in the lead with the literary studies known as *ars dicandi* (art of composition).

During the first half of the 13th century—later than in other Latin countries because of the greater vitality of the Latin tradition in Italy—the vernacular literature began to appear. Through it the life of the people found direct expression, the obstacle of an erudite language having been removed. In the early days, Italian vernacular was largely a reflection of French models, as is evident in the Provençal-sounding lyrics of the Sicilian school which had been formed at the court of Emperor Frederick II. In Bologna and Tuscany, during the second half of the 13th century, an original lyric—the *dolce stil nuovo*—came to be used. It was finished and powerful, and was used even by the youthful Dante. The sacred *lauda* (hymn of praise) had a more popular character and was fostered by the contemporary religious movement. It gave birth to the dramatic *lauda* and to the religious drama in the vernacular.

After 1300, Italy made such rapid progress in the field of culture as to stand in the forefront of Europe during the late Middle Ages. Italian culture of the *trecento* (14th century), while still imbued with the medieval spirit, had a distinctly lay character, both in its content and in the men who created it. It was actually the first great lay culture since the decline of the Roman Empire. This aspect, as well as the renewed interest in classical culture, made the Italian *trecento* a forerunner of the Renaissance. Almost contemporaneously, Tuscany gave birth to three giants of the new European culture. Dante Ali-

ghieri (1265-1321) gave in the *Divina Commedia* the most powerful synthesis of the Middle Ages, at a stroke raising the level of the Italian vernacular to the height of classical Latin literature, and by far surpassing all contemporary Romance literature. Petrarch (Francesco Petrarca, 1304-1374) in *Il Canzoniere* transformed the Provençal lyric and the *dolce stil nuovo* into a fine and powerful instrument of psychological analysis and made it an expression of a very personal sensitivity. In his Latin works, by promoting classical culture, he originated a historical and aesthetic understanding of the age, which was no longer medieval but modern. Giovanni Boccaccio (1313-1375) in the 100 tales of the *Decameron* created an entire world observed in everyday life, and originated the classic-sounding Italian prose, with its involved but harmonious and majestic periods. (See also sections on *Language* and *Literature*.)

Romanesque art, which was one of the major manifestations of Europe's new spiritual life, had one of its creative centers in Italy around 1100, although there it was tempered by the persistent influence of antiquity. It flourished especially in northern Italy with the so-called Lombard architecture (Sant' Ambrogio in Milan, the cathedral in Modena), and in central and southern Italy (Cathedral of Pisa), where the basilica tradition was strongest. In Venice, St. Mark's combined Byzantine architecture with some Romanesque elements. At the end of the 12th century, lay architecture also flourished in portals, towers (as in Pisa), and communal halls.

From the second half of the 12th century to the first of the 13th century, Romanesque sculpture attained its greatest development in intimate relation with ecclesiastic and lay architecture. Around 1200 we meet the outstanding personality of Benedetto Antelami (fl. 1177-1233), in whose sculpture we find the contained and powerful expression of a profound religious and moral life. During the first half of the 13th century, painting also broke away from Byzantine influence and gave evidence of a fresh and robust expression analogous to contemporary sculpture.

In the middle of the 13th century, Gothic art reached Italy after having flourished for a century in France. In Italy, however, the distinctive character of the Gothic was far less evident. Romanesque structures persisted, and Gothic was used mainly as a decorative adjunct. Italian Romanesque-Gothic architecture, both civil and religious, produced its masterpieces, especially in Tuscany and Umbria. More properly Gothic, but belonging to a far later period, is the Cathedral of Milan. The Gothic style influenced sculpture much more decisively, with Nicola (or Niccolò) Pisano or d'Apulia and his son Giovanni Pisano, and painting with the Siennese school, while the Florentine painter Giotto di Bondone (1276?-1337)—one of the most originally powerful personalities in all art history—stood apart as a precursor of the Renaissance. Dante and Giotto were the highest manifestations of Italian spiritual life, which had reached its full expansion. (See also section on *The Arts*; *GOthic ARCHITECTURE*; *ROMANESQUE ARCHITECTURE*.)

Characteristic of Italian art and literature at this period was their close relationship to the civil and religious life of the people. Italian religious life reached its greatest and most original intensity during the period from the 11th to the 14th centuries, in which the revival of lay culture

and civilian life was closely associated with ecclesiastical life and tradition. This was true despite the conflicts caused by the schismatic and heretical movements of Arnold of Brescia (1100?-1155, q.v.); the Waldenses; the Cathari, who were akin to the Albigenses of France; and the Fraticelli (Little Brothers), an offshoot of the Franciscans; and the stern repression of these movements by the church in the Inquisition (founded by Pope Innocent III around 1203). The principal instruments of this spiritual unity were St. Francis of Assisi (1182-1226), a highly original religious personality whose European-wide influence lasted for centuries, and the Franciscan movement. This movement was regularized by Honorius III in 1223, through the founding of the Franciscan Order, which collaborated with the other mendicant order, the Dominicans or Preaching Friars, founded in 1215 by the Spaniard St. Dominic (1170-1221), and also widespread in Italy. The Franciscan Order was harassed for more than a century by internal quarrels between different tendencies, some of which—such as the Fraticelli movement—brought it into conflict with the church. See also ALBIGENSES; CATHARI; DOMINICANS; FRANCISCANS; WALDENSES.

The Principalities and the Equilibrium Policy.—Following the fruitless attempt, in 1327-1330, of Louis IV to control Italy, the emperors practically abandoned the country. (Frederick III [r. 1440-1493] was the last emperor to be crowned in Rome by the pope, in 1452.) The papacy continued to be active in Italian politics, but first the popes' absence from Rome during the Avignon period (the so-called Babylonian captivity) from 1309 to 1377, and then the Western Schism (1378-1417), which set up a pope in Avignon against the pope in Rome, deprived their actions of effectiveness. (See also PAPACY.) Moreover, the Kingdom of Naples, following the death of Robert of Anjou (r. 1309-1343), ceased to have any guiding influence, while the Kingdom of Sicily stood apart and, upon the death of Frederick III (r. 1355-1377), became a dependency of Aragon (in 1409 it was joined to that kingdom).

From the mid-14th century, therefore, local influences were predominant in Italy. Naples and Sicily fought one another and were torn by internal strife, and in the Papal States, despite temporary reforms, the anarchy of local communal and feudal governments persisted. Between 1347 and 1354, there was an unsuccessful revolution against aristocratic power in Rome, led by Cola di Rienzi, who was killed by his opponents. The Florentine commune dominated Tuscany, while in Lombardy the Visconti (q.v.), lords of Milan after 1311, were able, in 1387, to overthrow the Scaligeri (della Scala) family, which had ruled Verona from 1260. Coalitions were formed against the Visconti, in which Florence and the popes joined, but these did not succeed in shaking their supremacy. Gian Galeazzo Visconti (r. 1378-1402), who was appointed hereditary duke by Emperor Wenceslaus in 1395, extended his dominion from Piedmont to Venetia, from Bologna to Pisa, and aspired to the crown of Italy.

After the death of Gian Galeazzo, the Visconti dominion fell apart. In Venetia, their inheritance was taken over by Venice, which had become the most powerful state in the peninsula, constantly tending to increase its territory, though lacking a general Italian policy. The power of the Visconti was reconstructed by Filippo Maria (r. 1412-1447), who was opposed by an alliance

of Venice and Florence. For three years after Filippo Maria's death, Milan was a republic and then passed into the hands of a new ducal dynasty headed by Francesco Sforza (r. 1450-1466), who had married Bianca Maria Visconti. (See also SFORZA.)

In the meantime, the power of the papacy was reconstituted by Martin V (r. 1417-1431), who brought to a close the Western Schism, and Naples and Sicily were reunited by Alfonso V of Aragon (Alfonso I of Naples, r. 1443-1458), who drove out the Neapolitan king, René I, duke of Anjou, in 1442. Florence, the most tenacious of the republics, was practically governed by the Medici (q.v.) after 1434, when Cosimo the Elder had with the support of the people defeated the oligarchy of the Albizzi family. Although a number of minor states continued to exist, these three principalities, with Venice and Milan, governed Italy.

During the second half of the 15th century, not without wars and disputes, a system of equilibrium was established among the five Italian powers under the patronage of Lorenzo de' Medici (r. 1469-1492). It was, however, an unstable equilibrium, deriving, as it did, not from a desire to enforce justice and peace, or even from the consciousness of political solidarity, but simply from mutual jealousy and suspicion. Temporary leagues were formed, but no stable and well-constituted federation was organized.

The independence of Italy was also imperfect and precarious. The emperor's nominal authority could always be re-established. Moreover, French control had been extended to Asti, and was often exercised in Genoa as a counterbalance to the domination of the Visconti. The Angevins, whose inheritance passed to the crown of France upon the death of Duke René in 1480, were perpetual pretenders to the Kingdom of Naples. Upon the death of Alfonso I, Naples and Sicily were again separated, Naples passing to his son Ferdinand I (r. 1458-1494), and Sicily being joined once more to Aragon. An Italian national consciousness, which might have opposed such foreign acquisitions, was lacking, particularly since the conquests seemed to have a personal character and the acquired states maintained their own individuality. The art of politics flourished in Italy, and Italian statesmen enjoyed a European reputation for ability and shrewdness. But their ability degenerated into virtuosity and intrigue, and they lacked vision or a direct and tenacious policy. For them, the pursuit of public affairs was a matter of personal interest, a problem of how to maintain and increase their power, and not a national service to be performed as a conscientious duty. Moreover, the various states (except, in part, Venice) were internally weak. They were still largely conglomerations of cities and territories—no longer city-states and not as yet unified modern states. The people, who no longer shared in public life, were estranged and passive.

The Renaissance.—The isolation of the governments from the people, which had developed during the 15th century, was accompanied by a detachment of cultural from social life. The traditional values of the Italian Middle Ages—religion and city—were shaken by the religious and political crisis. Beside these values, which were not forgotten but had lost their hold on popular feeling and were no longer so influential as they had been, we find in the higher levels of culture a

development of the individual, freed from the bonds of tradition but indifferent to the life of the community, and a pursuit of letters and science for their own sake. This spirit of free inquiry produced the cultural and artistic splendors of the Renaissance, which made of Italy during a century the mistress of arts and civilization of Europe. The political indifference of the age, however, prevented the development of national unity and made it impossible for Italy to withstand renewed foreign aggression.

Besides this change of point of view, there was in the 15th century a notable increase in the study of the authors of classical antiquity, a movement that has properly been termed humanism (q.v.). It meant research into original texts, correction of translations, and critical editions. Extremely important was the revival of Greek studies brought about by learned Byzantines—such men as Manuel Chrysoloras (1355?-1415) and Johannes Argyropoulos (1416?-?1486)—who had settled in Italy, and by their pupils. Together with the study of the classics, an original humanist literature developed in which Latin was no longer the medieval tongue modified by the use of vernacular, but became an art Latin claiming to be the original tongue of classical antiquity.

Italian literature, neglected during the 15th century in favor of Latin, rose to new heights at the beginning of the 16th century. It attained European fame and influence with the chivalresque poem *Orlando Furioso* by Lodovico Ariosto (1474-1533), which was followed by the epic poem *Gerusalemme Liberata* by Torquato Tasso (1544-1595); with the Petrarchan lyric school of Pietro Bembo (1470-1547); with the new classical school of comedy and tragedy; with the prose featuring ample and harmonious periods in oratory; with didactic writing (*Il Cortegiano* by Baldassare Castiglione, 1478-1529); and with political history. (See also section on *Literature*.)

The splendor and European influence of the Renaissance in the field of arts was as great or greater than it was in letters, with the Florentine, Venetian, and Lombard-Roman schools of painting and sculpture; with the new architectural styles of Filippo Brunelleschi (1377?-1446), Bramante (real name Donato d'Agnolo, 1444-1514), and their successors, who ingeniously renewed the ancient forms; and with the great and many-sided personalities of Leonardo da Vinci (1452-1519), Raphael (Raffaello Santi or Sanzio, 1483-1520), and Michelangelo Buonarroti (1475-1564). The Italian Renaissance created modern art and transmitted it to the other countries of western Europe. (See also section on *The Arts*.)

Modern science also received its first impetus from the Renaissance. The direct study of classical texts and insatiable curiosity seeking new paths led thinkers to shake off in science, or in natural philosophy, as it was called, the Aristotelian yoke. Scholastic philosophy, which had placed ancient thought at the service of faith, was replaced by the direct study, as an end in itself, of ancient authors, especially Plato and Aristotle. The result was a far freer and more intrepid philosophical thought, nourished by rationalism, which often neglected dogma and sometimes questioned it. (See also section on *Science*.)

Modern political history was also born in

Italy, with Niccolò Machiavelli (1469-1527), author of *Il Principe*, and Francesco Guicciardini (1483-1540), who wrote *Storia d'Italia*. Philology and erudition had their masters in the humanists Piero Vettori (1499-1583) and Carlo Sigonio (1524-1584).

The French and Spanish Invasions.—At the end of the 15th century, a divided Italy faced a united France and a united Spain, both of which wanted to increase their power by territorial acquisitions in the peninsula. The Italian principalities, instead of forming a union against foreign invasion, were drawn into the contest between France and Spain and sided with one or the other. France aspired to the Kingdom of Naples because of the Angevin inheritance, and to the Duchy of Milan because the duke of Orléans, the future King Louis XII (r. 1498-1515), was the grandson of Valentina Visconti, daughter of Duke Gian Galeazzo. Spain, already in possession of Sicily through the union of Aragon and Castile, opposed both French objectives.

The struggle began in 1494, with the invasion of the peninsula by King Charles VIII of France (r. 1483-1498), and ended with a Spanish triumph after Charles I, king of Spain (r. 1516-1556) and elected Holy Roman emperor as Charles V (r. 1519-1556), had defeated his rival Francis I, king of France (r. 1515-1547), and was crowned king of Italy by Pope Clement VII (Giulio de' Medici), in 1530. Empire and papacy were reconciled, after so many quarrels, over the body of Italian independence. The reconciliation was further confirmed by the final downfall of the Florentine republic (it had been restored in 1494, replaced by the Medici again in 1512, and renewed in 1527) in 1530, and the installation by the imperial armies of Alessandro de' Medici, a cousin of the pope, as duke in 1531. (His successor, Cosimo I [r. 1537-1574] was made grand duke of Tuscany in 1569.) The popes thereafter renounced the struggle for political supremacy in Italy, being satisfied with the Papal States, which the emperors, in their turn, fully recognized. The latter did not, however, exercise direct control over Italy, but renewed imperial sovereignty in the territory which had been the Kingdom of Italy. Empire and papacy, the supreme powers of the medieval world, which had lost all authority in the political field in matters which concerned western Europe, in Italy won out over local autonomies and the independent Italian states. With their victory, foreign domination was definitely established in the peninsula.

The two major contested principalities, the Kingdom of Naples and the Duchy of Milan, both passed to the king of Spain, who received the investiture for the first from the papacy, in 1504, and the second as a fief from the empire, in 1556. (Spain had controlled Milan since 1535, when Francesco II, the last Sforza duke, died.) Further French attempts against Spain by Francis and by Henry II (r. 1547-1559) failed. The Treaty of Cateau-Cambrésis (1559) sealed Spanish control of Italy. (In addition to the possessions already mentioned, Sardinia had been Aragonese since the end of the 13th century, and the State of the Presidii, an enclave in Tuscany, was now under Spanish control.) France abandoned all her Italian acquisitions. See also *FRANCE—History*; *SPAIN—History*; biographies of important figures.

FROM THE COUNTER REFORMATION TO
THE FRENCH REVOLUTION

The Counter Reformation and the 17th Century.—The Italian states which came under Spanish control in the 16th century retained separate administrations, preserving a formal individuality and local institutions. None of them, however, constituted an organic whole with powers derived from the will of the people. In the main, they represented class interests in conflict with one another. For this reason, they tended to favor the supreme foreign authority, which was largely absolute and met with little or no opposition. Such revolts as that of Masaniello (properly Tommaso Aniello) in Naples in 1647, and others in Palermo and Messina (1670) were inconsequential episodes.

Spanish hegemony in the peninsula encountered very little opposition from the Republic of Venice, the Papal States, or the Grand Duchy of Tuscany, all of which followed a neutral policy. The Duchy of Savoy, however, reconstituted after Cateau-Cambrésis by Emmanuel Philibert (r. 1553–1580), pursued an active policy with both France and Spain, endeavoring to extend its domains in Monferrato, Lombardy, and Liguria, as well as in France and Switzerland. Its success for the moment was limited, but the Duchy of Savoy eventually became the major independent power in Italy. (See also SAVOY, HOUSE OF.)

In all of these states, the passage from feudal to absolute government was smoothly accomplished. The most perfect despotism was probably that of the Republic of Venice, in which the oligarchy became increasingly restricted and rigid (Council of Ten; state inquisitors). The weakest was the papal power.

Religious absolutism went hand in hand with political despotism. The ideas of the Protestant Reformation at first spread widely in Italy, but they were soon crushed by the papacy, supported by the various governments, with the Inquisition or Holy Office (made universal in 1542) as its principal instrument. In 1559, the Inquisition was supplemented by the first index of forbidden books. The Catholic Counter Reformation, codified during the Council of Trent (Trento, 1545–1563), had its headquarters in Italy, with the papacy, the Jesuit Order (founded in 1534), and other religious orders, and its religious and moral influence permeated the Italian people. (See also COUNTER REFORMATION; JESUITS; REFORMATION; TRENT, COUNCIL OF.)

With the end of the Renaissance and the progress of the Counter Reformation, Italian culture lost the predominant position which it had held in Europe for about 200 years. In the countries beyond the Alps, particularly those of western Europe, new national cultural strains, once they had felt the vivifying influence of the Renaissance, developed autonomously and vigorously. Little by little, with a reversal of roles, they acquired a preponderant influence on Italian culture. This autonomous foreign evolution was noticeable in every field—philosophy, philology, physical and mathematical sciences, natural sciences, letters, and art.

Foreign influence was more evident in Italy in the scientific than in the artistic and literary fields. In philosophy as well as in science, Italy held an important place until the first years of the 17th century, but in the course of that century she fell behind other western European

countries. Post-Renaissance Italian literature commanded far less attention than science or philosophy, because there were no names which could compete with the great contemporary French, Spanish, and English writers. In art, on the other hand, Italy, and particularly Rome, was more than ever the land to which men turned for knowledge and inspiration. One and the other, however, were sought from the old masters, the landscape, and the classical ruins to a greater degree than from new artists. Italian painters and sculptors of European reputation became rare: a position of greater eminence was reserved to architecture, which spread widely outside of Italy with the baroque school. A great artist of European influence was the architect and sculptor Giovanni Lorenzo Bernini (1598–1680). (See also section on *The Arts*.)

During the first part of this period, Italy still enjoyed a leading place in scientific philosophy. She contributed to the definite advance from Aristotelian scholastic philosophy, with Bernardino Telesio (1509–1588), Tommaso Campanella (1568–1639), and especially Giordano Bruno (1548?–1600). An even greater impulse was given to modern science by Galileo Galilei (1564–1642), the great physicist and astronomer. But the imprisonment and exile of Campanella, the arrest of Bruno by the Inquisition and his death at the stake, and the retraction forced from Galileo concerning the Copernican system (1633), marked the extinction of independent thought in Italy. The country not only lost its intellectual primacy but dropped from the orbit of productive European culture, limiting itself to pure erudition and scholastic word battles. Modern thought lived and progressed outside of Italy. (See also section on *Science*.)

In the late 15th century, Italy had enjoyed an extraordinary economic prosperity, probably greater than that of any other part of Europe. This condition was altered simultaneously by political events and by geographical discoveries. The road to India, opened with the circumnavigation of Africa by Vasco da Gama, and the discovery of America by Christopher Columbus, transferred the center of world commerce from the Mediterranean to the Atlantic. This was a serious blow to Venice, Genoa, and all of Italy. In the Mediterranean, the predominant position of Venice was endangered and almost destroyed by the Ottoman Empire, which extended from Constantinople to Greece and Egypt. Isolated victories against the Turks, like the Battle of Lepanto (q.v.), in 1571, wrought no change in this situation until the end of the 17th century. The subsequent decadence of the Ottoman Empire was of advantage to Austria and Russia, not to Italy. Besides the Turkish menace, there were in this period raids of Moslem pirates from North Africa against the coasts of southern and central Italy.

18th Century Reformism.—The War of the Spanish Succession (1701–1714) brought to an end Spanish control of Italy. The treaties of Utrecht (1713) and Rastatt (1714) replaced Spain with Austria in Milan and Naples, a change which meant a better government in terms of order and administrative capacity. The duke of Savoy, Victor Amadeus II (r. 1675–1730), increased his territory in Piedmont with the acquisition of Alessandria and Monferrato. He also received Sicily with the title of king. In 1720, however, he was forced to cede Sicily

to Austria, receiving Sardinia in exchange. Thereafter, the territory of the house of Savoy was called the Kingdom of Sardinia. In 1748, by the Treaty of Aix-La-Chapelle (Aachen), at the close of the War of the Austrian Succession, the territory of the kingdom was extended to include that part of the Duchy of Milan west of the Ticino River. (See also SUCCESSION WARS; UTRECHT, PEACE OF.) Meanwhile, Tuscany passed, upon the extinction of the house of Medici, to Duke Francis of Lorraine (r. 1737-1745), who was married to Maria Theresa of Austria, and upon his death to their son, Leopold I (r. 1745-1790; later Emperor Leopold II). The advent of the house of Habsburg-Lorraine brought greater governmental efficiency to Tuscany. In 1734, the Kingdom of the Two Sicilies was freed from Austrian control and reconstituted as an independent state under a branch of the Spanish Bourbons. The first ruler, Charles IV (r. 1734-1759), upon his accession to the Spanish throne as Charles III, left the kingdom to his son, Ferdinand I (r. 1759-1806; 1815-1825).

These extensive territorial changes did not radically modify the condition of Italy, which remained divided under foreign control and impotent in international affairs. A far greater transformation took place in the internal policy of several of the Italian states. This was a period of governmental reform, led by Austrian Lombardy, Lorraine Tuscany (with the great figure of Leopold I), and, at some distance, Bourbon Naples. Their reforms were characterized by antifeudalism; administrative and bureaucratic reorganization on a uniform and centralized basis replacing the chaos of legislation, institutions, and strata of customary privileges; anticlericalism, or rather anticurialism (that is, limitation of the power of the church and especially of the pope in favor of the state); religious tolerance and incipient lay policy; and humanitarianism, which was especially manifest in the revision of penal law and in Tuscany went as far as the abolition of capital punishment.

These reforms, like similar ones outside of Italy, were largely the result of the application of the principles of 18th century rationalism. The spread of these principles in Italy, with the consequent spiritual revival of the nation, is the most important trend in this period. It marked the beginning of the Risorgimento (the rebirth of Italy). With this movement, Italy returned to the great, European-wide tradition of the Renaissance.

Italian culture made notable contributions to rationalism in the fields of history (Lodovico Antonio Muratori, 1672-1750; Pietro Giannone, 1676-1748; Giovanni Battista Vico, 1668-1744) and of economics and political science (Cesare Bonesana, marchese di Beccaria, 1735?-1794; Pietro Verri, 1728-1797; Antonio Genovesi, 1712-1769; Ferdinando Galiani, 1728-1787; Gaetano Filangieri, 1752-1788). As in the first *risorgimento* during the communal age, religious movements had a part in the second. Jansenism and Gallicanism (q.v.), which were associated in France, by joining with the 17th century Augustinian movement in Italy, emphasized the latter's innate anti-Jesuit character (see AUGUSTINIANS). Gallicanism and Jansenism gave the state a theoretical basis and a moral impulse in jurisdictional discussions with the church. They encouraged hopes and fostered

plans for ecclesiastical reforms of not merely political but moral value.

In the reforms undertaken by the governments and promoted by writers and thinkers there was a spirit both of civic progress and of moral and religious awakening. The reforms lacked popular appeal, however, and consequently had no wide national basis. The Italian thinkers of the 18th century reached a far more limited audience in Italy than would have been the case in either France or England. In general, the people remained indifferent and at times even hostile. Moreover, the rulers, who acquired added powers through the reforms, did not face the fundamental problems of which the best minds were already fully conscious—such problems as civil equality, civil and political liberty, constitutionalism, and popular control of, and participation in, government.

Far more effective than the action of the rulers, because of their moral and political inspiration, were the works of a number of Italian writers, particularly Giuseppe Parini (1729-1799) and Vittorio Alfieri (1749-1803). The former, by renewing Italian lyric poetry with his odes, became the interpreter and promoter of civil and moral ideals, and in his satirical poem *Il giorno*, by caricaturing the idle and pretentious nobility of the time, went beyond contemporary political reformism to develop a sense of social justice reflecting a philosophic and Christian consciousness. The latter, in his tragedies and other works, preached the hatred of all tyrannies, the love of liberty, and a sense of personal dignity.

FROM THE FRENCH REVOLUTION TO UNIFICATION

The Revolutionary-Napoleonic Period.—About 1790, the progressive reformism of the Italian governments was halted and there were signs of reaction. The events of the French Revolution, by frightening the rulers, caused the reactionary tendency to become permanent. At the same time, the new ideas influenced a restricted Italian circle, and Jacobin clubs were formed in a number of cities.

In 1792, Victor Amadeus III (r. 1773-1796), king of Sardinia, joined the First Coalition against revolutionary France and promptly lost Nice, Savoy, and part of Piedmont. Four years later, Napoleon Bonaparte, who commanded the French armies in Italy, defeated the Austrians at Millesimo, and the Piedmontese at Mondovì. Victor Amadeus was compelled to cede Savoy and Nice to France and to permit the establishment of French garrisons in the Piedmontese fortresses. Meanwhile, on May 10, 1796, Napoleon won the Battle of Lodi, and shortly thereafter controlled most of Lombardy. A strong movement for liberty, democracy, and unity developed in Lombardy and Emilia and spread to the rest of the peninsula. Under the protection of the French armies, a number of republics were formed—the Ligurian (1796); the Cisalpine (Lombardy and Emilia, 1797); the Roman (1798); and the Parthenopean (Naples, 1799). (See CISALPINE REPUBLIC; PARTHENOPEAN REPUBLIC.) A minority of cultivated noblemen and, to a greater extent, the middle class took part in this movement, but the people remained passive, if not hostile. Venice, which had also been transformed into a democratic republic, in 1796, was ceded by France to Austria in exchange for

Lombardy and the Belgian provinces under the terms of the Treaty of Campoformio (1797). In 1799, the French occupied Florence and forced the grand duke of Tuscany, Ferdinand III (r. 1790-1799), to flee.

In 1799, the Austro-Russian armies of the Second Coalition drove the French from Italy. There was a popular as well as a clerical and reactionary movement against the French and the Jacobins, and the latter were massacred in both Piedmont and Naples. The former rulers returned to their thrones. Within two years, however, Napoleon, now first consul of France, was once more in control of the peninsula, and the Treaty of Campoformio was confirmed by the new Treaty of Lunéville (Feb. 9, 1801), which further provided that Tuscany be ceded to Parma. In 1802, Piedmont was annexed to France, and King Charles Emmanuel IV (r. 1796-1802) abdicated in favor of his brother, Victor Emmanuel I (r. 1802-1821), whose kingdom had been reduced to the island of Sardinia. (French acquisition of Piedmont was confirmed in 1805 by the Treaty of Pressburg, by which France also received Parma and Tuscany.) In 1802 the Cisalpine Republic was renamed the Italian Republic, and, in 1805, the Kingdom of Italy, comprising Lombardy, Venetia (ceded by Austria under the Treaty of Pressburg), Emilia, and part of central Italy. Napoleon, who had become emperor of France in 1804, was now crowned king of Italy, Eugène de Beauharnais serving as his viceroy. The Ligurian Republic was annexed to France (1805). In 1806, Ferdinand I was driven from Naples by Joseph Bonaparte, who ruled until 1808, when he was succeeded by Joachim Murat. (Sicily continued to be ruled by the Bourbons.) Pope Pius VII (r. 1800-1823), with whom the Italian Republic had concluded a concordat in 1803, was deported from Rome in 1809, and the Papal States (except Marche, which became part of the Kingdom of Italy) were incorporated in France.

The Napoleonic government was a police regime serving an enlightened despotism. Italy was completely dependent upon France and French interests. Representative bodies, where they existed, had a fictitious life; political liberties were nonexistent. The administration of government, however, was almost entirely in the hands of Italians, who accomplished with revolutionary methods what the reformist movement of the 18th century had begun: the disappearance of feudal and economic bonds and of church privileges (*manomorta*, mortmain); the creation of regular and centralized administrations; and the establishment of uniform weights and measures. In addition, public instruction and hygiene were given due attention. With the suppression of customs and tariff barriers, industry and commerce received a new impulse. Great roads were built, public works were fostered, cities were enlarged, and progress was noticeable in industry and agriculture. Of no small importance was the organization of an army of the Kingdom of Italy. Foreigners created the army and commanded it, and it fought almost always for foreign interests. The officers and men were Italian, however, and the army provided them with technical training and gave them a focus of national sentiment. The very name Kingdom of Italy kept this sentiment alive. Nevertheless, the Napoleonic period represented on the whole a spiritual, and political retrogression when com-

pared with the ideals of liberty, democracy, and unity of the brief revolutionary years.

Restoration and Risorgimento.—In 1815, after the fall of the Napoleonic empire and the conclusion of the Congress of Vienna, the political and territorial condition of Italy resembled that of 1748, following the Treaty of Aix-La-Chapelle, but it was even less favorable to internal progress or to the development of national independence. The independent republics of Venice and Genoa had disappeared, and the Republic of Lucca was made into a Bourbon duchy under Maria Luisa of Parma, who served as regent for her son Charles Louis. The other states were reconstituted, the Kingdom of Sardinia receiving Liguria. Lombardy and Venetia were under Austrian control, and Austria became the dominant power in the peninsula, which was regarded as her sphere of influence by the other states in the Holy Alliance. Austrian sovereigns ruled in the Grand Duchy of Tuscany (Ferdinand III, restored in 1814, was succeeded by his son Leopold II, r. 1824-1859); in the Duchy of Modena (Francis IV of Este-Lorraine, who was succeeded by his son Francis V, r. 1846-1859); and in the Duchy of Parma, which, with Piacenza and Guastalla, was given to Marie Louise, wife of Napoleon and daughter of Emperor Francis I of Austria. The Kingdom of the Two Sicilies (Ferdinand returned to Naples in 1815; he was succeeded by his son Francis I, r. 1825-1830), was bound by a treaty to Austria. In Piedmont, the restored Victor Emmanuel I and the ruling class regarded Austria with hostility, or at least with suspicion, but were bound to her in the common conservative interest of opposing liberal movements. This interest also made the other Italian sovereigns dependent upon Austria. The Papal States were reconstituted by Pius VII, who returned from exile. (See also VIENNA, CONGRESS OF; HOLY ALLIANCE.)

The restoration of the old order probably went further in Italy than in any other European country. This was particularly true of Piedmont under Victor Emmanuel I. The Austrian provinces, Tuscany, and Naples preserved to some extent the traditions of 18th century and Napoleonic reformism. In these states also, however, there was a marked retrogression from the Napoleonic period, which had taken Europe by storm, brought new energies to the fore and new classes into public life, and maintained the principle of popular sovereignty in place of divine right. Restoration Italy appears reactionary even in comparison with the period of 18th century reformism. The reforms which had taken place before and during the Napoleonic period were maintained, when they were maintained, only through fear of social disturbances or as instruments of absolutism and as a barrier against further innovations—that is, in a conservative and reactionary spirit.

In contrast to the situation in the 18th century, the distance between the governments and progressive public opinion in restoration Italy was very great. Classical and medieval memories, the tradition of local autonomy, the teachings and the reforms of the 18th century, the recent revolutionary experience, all fostered liberal ideas. National sentiment, pride in the Italian people, who had created ancient Rome, and the present foreign oppression, all helped to increase the desire for independence and to develop the idea of a *risorgimento*, or rebirth. This

term had at first merely a literary and cultural significance, but later, after the writings of Vittorio Alfieri, assumed an ethical and political meaning. The conception of governmental unity, for which a united nation offered a solid basis, and to which the Napoleonic Kingdom of Italy had given an initial reality, was among the last to reappear. When it did reappear, it was rather timid and uncertain.

These ideas and sentiments were active in the minds of a chosen few. The nobility—with some exceptions in Lombardy—was largely uninterested, the clergy was almost entirely hostile, and the peasants knew nothing about them. National ideas found sympathy instead in the middle class, which was the most alert and most active part of the population, and which had suffered more than any other group from the reactionary ordinances of the restoration. The bureaucracy was in the hands of noblemen, church officials, and foreigners. Industry and commerce were hampered by customs barriers, weights and measures were no longer uniform, a suspicious vigilance was constantly exercised, and a number of aggravating rules were enforced. The administrative and judicial organizations were insufficient; cultural life was obstructed; and so was every form of activity with which the middle class, which had for some time grown and prospered in Italy, was concerned.

Although the Italian liberals and patriots constituted a minority, it was a larger and more varied one than is generally presumed. From the upper middle class, with a few noblemen, the movement extended rapidly to the artisans. The bravest and most impatient conspired through secret societies. Of the origins, bylaws, and programs of these societies, little is known with certainty. Probably they derived their common origin from Freemasonry, which in the revolutionary and Napoleonic period had spread widely in Italy. Chief among them was the Carbonari (q.v.), which seems to have absorbed others, such as the Gueffi (Guelphs) in Lombardy and Romagna, whose purpose was to promote Italian independence and to form a league among the various states, probably with the pope as president. The Carbonari advocated constitutional government and independence, but spoke neither of a republic nor of unity.

During the 15 years following the restoration, the Italian national movement was intimately connected with similar movements elsewhere in Europe, particularly in France. They all had common memories of the Revolutionary-Napoleonic period. Napoleon, deposed and exiled by the Holy Alliance, became a symbol of liberty. The armies were hotbeds of liberal movements. There was a common public opinion and state of mind in Europe, so that events in one country had immediate repercussions in others.

The revolution which broke out in Spain in January 1820 had its effect in Naples in July of the same year, with the insurrection of soldiers belonging to the Carbonari, led by Guglielmo Pepe, a former general in Murat's army. Ferdinand I granted a constitution, and a Parliament was assembled. Then the king, having left the country, accepted Austrian intervention, which the Congress of the Holy Alliance, meeting at Troppau and Laibach, had approved. Austrian troops easily scattered the constitutionalists (March 1821), and the absolute monarchy was restored.

As the revolution in Naples was ending, another one broke out in Piedmont. Here also the Carbonari had penetrated the army and had become a rallying point for all who were dissatisfied with the restoration. The movement supported the house of Savoy, but wanted Victor Emmanuel to establish a constitutional government and march against Austria, reviving the ancient Savoy aspiration for a union of Lombardy and Piedmont. Agreements had been made with the federalist Lombards and with the Carbonari in Romagna and Marche. The second in line to the throne, Prince Charles Albert of the Savoy-Carignan branch of the family, sympathized with the Carbonari and entered into negotiations with them. The revolution began on March 10. Victor Emmanuel abdicated in favor of his brother Charles Felix (r. 1821-1831). Charles Albert became regent and granted a constitution, but he was disavowed by the new king and left the country. The royal troops, with Austrian aid, defeated the constitutionalists near Novara, on April 8.

Neither the people nor the middle class took part in these revolutions, which were the work of officers and noblemen. Joint plans, organization, common sense, and constancy were lacking. The two movements had, however, demonstrated that ideas of liberty, independence, and even national unity were spreading without encountering great hostility among the majority of the population, and that the rulers alone, without Austrian support, were unable to prevent their success. Insurrections did not take place in Lombardy and Venetia, but the Carbonari conspired actively. Numerous arrests were made, and severe sentences of hard labor in the fortress of Spielberg in Brno (Brünn), Moravia, followed. The moral and material sufferings of the prisoners were revealed to Europe with the publication in 1832 of *Le mie prigioni* by Silvio Pellico; his simple and unembittered little book "was worse for Austria than a lost battle."

The Italian and French Carbonari were in touch with one another. When the latter shared in the successful revolution in Paris, in July 1830, and Louis Philippe had succeeded to the French throne, the Italian patriots, trusting in the principle of nonintervention which had been proclaimed by the new French government, revolted in Modena, Parma, and the Papal States (February 1831). In Bologna, an assembly declared the temporal power of the pope at an end, proclaimed the union of the liberated territory under the name United Italian Provinces, and drew up a provisional constitution. Austria, ignoring French opposition, intervened and re-established the former governments in March. New revolts later in the year were put down in January 1832. Louis Philippe sent troops to occupy Ancona. (The foreign troops were finally withdrawn in 1838.)

The failure of the revolution in central Italy caused the decline of the Carbonari and its affiliated societies. They were replaced by another secret society, Giovane Italia (Young Italy, q.v.), which was of an entirely different character. It was founded in 1831 by a young Genoese and former member of the Carbonari, Giuseppe Mazzini. He gave the society as its aim an insurrection of all the people of Italy, and as a program the establishment of a united republic, which was to make Italy, in the name of God and the people, the leader of a European

revolution for social, religious, and political reconstruction. The Young Europe movement was organized in 1834. The confederated nations of the movement were to serve a united and redeemed humanity, which was to progress toward a divine sublimation. The European importance of the Italian revolution and the unitarian idea, which were closely connected, found in Mazzini, for 40 years, an eloquent and tireless champion. By intimately associating the political program with moral renovation and the mission of serving all humanity, he brought the Italian Risorgimento to its greatest moral height and contributed more than anyone else to lending it universal significance.

Mazzini's propaganda was highly successful at first. Affiliated groups were organized all over Italy, particularly in the Kingdom of Sardinia. Charles Albert (r. 1831-1849), having discovered the diffusion of Giovane Italia in the ranks of the army, undertook very severe measures of repression in 1833. An attempt to invade Savoy from Switzerland, in February 1834, failed, and the movement declined for several years. Around 1840, Mazzini revived the work of Giovane Italia, this time from London, with a center of organization and propaganda in Paris. Other uprisings took place, particularly in Romagna and the Kingdom of the Two Sicilies. The expedition of Attilio and Emilio Bandiera in Calabria, in 1844, ended in their execution and that of their comrades.

The failure of these insurrections favored the development of a moderate liberal party which would endeavor to obtain from the existing governments political reforms and an Italian confederation. It was hoped that these reforms would be the first step toward Italian independence. The latter, the moderates thought, might be obtained at a later date, either through war with Austria, or through an agreement whereby Austria would renounce Lombardy and Venetia in exchange for territorial compensation in eastern Europe. One group of the moderate party, called the Neo-Guelphs, attributed great importance to an agreement with the pope, who they thought should be the head of the proposed confederation. Its most authoritative spokesman, Vincenzo Gioberti, demanded in *Del primato morale e civile degli italiani*, published in 1843, that the moral direction of the national movement be assumed by the papacy. Other distinguished writers among the moderates were Cesare Balbo (*Delle speranze d'Italia*, 1843); Massimo d'Azeglio (*Ultimi casi di Romagna*, 1846); and Niccolò Tommaseo.

The writings of these moderates are part of the general picture of Italian literature during the first half of the 19th century, all or mostly all of which had a patriotic, or at least a moral and civic, character. The romantic movement, which came to Italy by way of Germany and France—and of which the greatest Italian representative was Alessandro Manzoni (1785-1873), author of the *I promessi sposi*—made an essential contribution to patriotic writing. Other writers, democrats and republicans, played an important part in this civic literature. Besides Mazzini, there were Carlo Cattaneo (1801-1869) and Giuseppe Ferrari (1812-1876), who advocated radical liberalism and a federalist, republican organization of Italy. To the political writers and poets like Manzoni, Giovanni Berchet (1783-1851), and Giovanni Prati (1815-

1884), we may add historians such as Balbo, Carlo Troya (1784-1858), and Michele Amari (1806-1889), all of whom fostered patriotism by recalling Italy's past. Reviews like *Il Conciliatore* and *Antologia* made use of literature for the same purpose.

This political, historical, and literary production lent to the political movement of the Risorgimento an idealistic foundation such as few political movements have ever had. Only the strength of these spiritual currents can explain the proportions which the Italian popular movement suddenly assumed in 1846-1848, and the fact that after an initial failure it began again and moved rapidly toward its final, overwhelming success. (See also section on *Literature*.)

The election of Pope Pius IX (r. 1846-1878) seemed to favor the success of the liberal-moderate program. The pope proclaimed a broad political amnesty and initiated reforms which were imitated first by Leopold II of Tuscany, and later by Charles Albert. These reforms—greater press freedom and the institution of a civil guard and of administrative and consultative bodies—were accompanied by popular manifestations of great enthusiasm, systematically organized. These manifestations were evidence of the return of the Italian people to public life, from which they had been excluded by centuries of servitude and passivity.

An anti-Bourbon revolution, victorious in Sicily in January 1848, created a strong liberal movement in Naples. On February 10, King Ferdinand II (r. 1830-1859) granted a constitution to his subjects. Similar constitutions were introduced by the rulers of Tuscany (February 17) and Sardinia (March 4), and by the pope (March 14). (In 1847, Tuscany had purchased Lucca from Charles Louis, who had succeeded to the throne of Parma as Duke Charles II upon the death of Marie Louise.) At the same time, the French revolution of February 1848, which replaced the house of Bourbon-Orléans with a republic, spread to Germany, Austria, and Italy. The people of Milan arose in the "five days" (March 18-22) and drove out the Austrians. Venice followed their example and proclaimed a republic on March 22. Charles Albert, on whom the Lombard moderates had called for aid, declared war on Austria on March 23 and adopted the three-colored flag inherited from the revolutionary movements of 1796-1797. Tuscan, Roman, and Neapolitan troops took the field against the Austrians. Lombardy and Venetia voted to unite with Piedmont and to recreate a kingdom of northern Italy.

After a few initial successes, Charles Albert was defeated by the Austrians in the Battle of Custoza (July 23-25), and was obliged to conclude, on August 9, the Armistice of Salasco and withdraw beyond the Ticino River. The other rulers abandoned the cause of national independence. Previously, on April 29, the pope had declared that he could not participate in the war because of his position as the head of all Roman Catholics. This statement pointed up the incompatibility between the positions of head of the church and national sovereign and meant the end of the Neo-Guelph movement. The democratic movement gained the ascendancy, particularly after Pope Pius and Leopold II had left their states (in November 1848 and February 1849, respectively). On Feb. 9, 1849, a constituent assembly proclaimed a republic in Rome,

which Tuscany joined. Giuseppe Mazzini was placed at the head of a governing triumvirate, which also included Aurelio Saffi and Carlo Armellini. The Catholic powers—Naples, Spain, Austria, and France—intervened on behalf of the pope. A French army commanded by Gen. Nicolas Oudinot besieged Rome, which, after a heroic resistance led by Giuseppe Garibaldi, was forced to capitulate (June 30). The Austrians re-established papal sovereignty in the provinces of Bologna and Romagna, and in Marche and Umbria. An Austrian garrison was established in the legations, and a French garrison in Rome. On July 17, the pope revoked the constitution. Meanwhile, the dukes of Modena and Parma (Charles II, who had abdicated, was succeeded by Charles III, r. 1849–1854) were restored, and in May 1849, Leopold II was reinstated in Tuscany by the Austrians. (The Tuscan constitution was abolished in 1852.) Ferdinand II abolished the constitution of Naples in 1848, and, in May 1849, reconquered Sicily by bombardments which earned him the name King Bomba.

On March 12, 1849, Charles Albert again declared war on Austria, but was defeated at Novara on March 23 and immediately abdicated in favor of his son, Victor Emmanuel II. The new king made peace with Austria on August 9, but remained faithful to the constitution and to the national cause. Exiled patriots from every part of Italy made Turin, the capital of Piedmont, their meeting place. See also biographies of important figures.

The Unification of Italy.—The federalism of the moderates lost ground after the catastrophes of 1849, and the advocates of a united Italy gained support. Of the two principal groups of Italian patriots, the republican-Mazzinian and the Savoy-monarchist, the latter was less unitarian than the former and was prepared, if necessary, to accept a compromise between federalism and unity. Mazzini, although he did not reject the contribution of the house of Savoy, believed that the secret conspiracies and popular insurrections should be continued. From Lausanne and London he directed his followers in Italy, as in the abortive revolts of Mantova (Mantua) in 1852, and Milan in 1853. Although Mazzini's enterprises all failed, they were not useless to the national cause. They kept alive the spirit of resistance and hatred of Austria, which was aggravated by the repressive government of the Austrian officials, and by such actions as the execution, in 1853, of five patriots, called the martyrs of Belfiore. The Mazzinians also spread the idea of unity and counteracted the propaganda in southern Italy for a separate kingdom under Prince Napoléon Murat, son of Joachim, by means of the expedition of Carlo Pisacane to Sapri, Campania, in 1857. Finally, they offered an excellent means of presenting the national cause to the other countries of Europe.

From November 1852 to July 1859, Count Camillo Benso di Cavour was prime minister of the Kingdom of Sardinia. He believed that progress could be made by constitutional means and that groups of different political tendencies could work together in harmony. Himself the leader of the Right Center wing of the Piedmontese Liberal Party, he formed his government with the support of Urbano Rattazzi, leader of the Left Center. Cavour's was a career of manifold and indefatigable activity.

His subtle and resourceful mind was always ready to make the best of every situation and to adapt itself to any circumstance. Before he took office, the ecclesiastical courts had been abolished, and the right of religious bodies to acquire real property had been restricted (April 1850); now, in 1855, all religious orders which were not engaged in preaching or educational and charitable activities were abolished—that is, deprived of their juridical personality. The conservative Catholic element was strongly opposed to these measures, and a conflict with the papacy ensued.

With regard to Italian aspirations, Cavour acted with prudence and adroitness. He made the liberals of the peninsula understand that they must rest their hopes in Piedmont. At the same time, he abstained from provoking Austria. He did, however, react to an Austrian provocation in 1853 by recalling the Piedmontese ambassador. It was Cavour's aim to place Piedmont at the head of the national movement which was endeavoring to form at least a kingdom of northern Italy. But he wanted the initiative to be taken by the government of Piedmont, and thereby assure the preservation of the monarchy and of bourgeois-liberal constitutionalism. He counted on the support of France and Great Britain, and particularly on Napoleon III's interest in Italy. (Mazzini, on the other hand, was bitterly opposed to an alliance with a foreign and illiberal monarch.) In the meantime, Cavour endeavored to take advantage of Piedmont's participation in the Crimean War on the side of the Western powers. Although the Congress of Paris at the close of the war (1856) did not bring Italy tangible results, Piedmontese prestige was increased, relations with France became more intimate, and Russia was approached at a moment in which she was hostile to Austria, which was also losing the support of Prussia.

At this time, a fusion of the monarchists with a majority of the republicans took place through the agency of the Società Nazionale, which was founded in 1857 by Daniele Manin (president of the Venetian Republic in 1848–1849), with the assistance of Giuseppe La Farina and Giorgio Guido Pallavicino-Trivulzio and the secret support of Cavour. The society accepted the house of Savoy on the condition that it favor Italian unity and independence. Garibaldi adhered to its program; Mazzini did not.

In July 1858, Napoleon III and Cavour made a secret agreement at Plombières, which was ratified by a formal treaty in January 1859. It provided that Napoleon would join Piedmont in a war against Austria, that an Upper Italian Kingdom would be formed, and that France would receive Nice and Savoy. War followed (April 29, 1859), and the Austrians were defeated at Magenta (June 4) and Solferino (June 24). In May, there were peaceful revolutions in Tuscany, Parma, and Modena, with the flight of their rulers (Leopold II; Robert, r. 1854–1860; and Francis V), and in June, there were revolts in the legations. Napoleon, frightened by these revolts and by the cost of the war, made a separate armistice with Emperor Francis Joseph of Austria on July 8. The two emperors met at Villafranca on July 11 and agreed that Austria should retain Venetia, but that Lombardy, with the exception of Mantova and Peschiera, should be ceded to France, which would turn it over to Piedmont. The rulers of Tuscany and Modena should return, but without external force. (These terms

were confirmed by the Treaty of Zurich, on November 10.) Victor Emmanuel accepted the Austrian retention of Venetia, and Cavour resigned. Meanwhile, assemblies in the three duchies and Romagna had voted for union with Piedmont. Cavour, who returned to office in January, entered into diplomatic negotiations with Napoleon III, with a view to annexing this territory. In March, plebiscites were held in the four areas, all of which voted to join the Kingdom of Sardinia. By way of compensation, Sardinia ceded the provinces of Nice and Savoy to France (Treaty of Turin, March 24), subject to a referendum, which was held in April and resulted in approval of the acquisition of these two areas by France.

From this moment, the making of a united Italy progressed rapidly. The expedition of the One Thousand, headed by Garibaldi, overthrew the Bourbon government in Sicily (May 27, 1860) and Naples (September 7) with the program "Italy and Victor Emmanuel." King Francis II (r. 1859–1861) fled to Gaeta. In order to overcome the last Bourbon resistance, and assume once more the direction of the movement, the Piedmontese government occupied Marche and Umbria (September 1860), detaching them from the Papal States. Following favorable popular referendums in all these states (Naples and Sicily, October 1860; Marche and Umbria, November 1860), Victor Emmanuel II, on March 17, 1861, assumed the title of king of Italy by means of a law voted by the first national Italian Parliament, which met in Turin on February 18.

The collaboration between the Action Party (democratic-republican movement) and the liberal monarchist government of Piedmont was accepted by Mazzini, who set his republican program aside. He intended, however, that the Italian people should be consulted and allowed, freely, directly, and integrally, to choose their form of government; he demanded that a national covenant be drawn up by a constituent assembly. Moreover, the wing of the Action Party which did not follow Mazzini and was grouped around Garibaldi would not wait for the government to take the initiative in liberating Venetia and Rome, and repeatedly acted of its own accord. Out of this situation arose the Battle of Aspromonte (Aug. 29, 1862) between the royal troops and Garibaldi, who wanted to march on Rome. Garibaldi himself was taken prisoner, but was freed by an amnesty on October 5.

On March 27, 1861, Rome had been proclaimed the capital of Italy, on the initiative of Cavour, who also endeavored to have Pope Pius IX renounce temporal power in exchange for full liberty for the church in ecclesiastical affairs, according to the principle of a "free church in a free state," which Cavour believed would mean a renovation of the Catholic world. His efforts having failed, he entered into negotiations with France. Because of his early death (June 6, 1861), the negotiations were continued by others and resulted in the September Convention (Sept. 15, 1864), whereby Italy pledged herself not to attack, or to allow attacks on, the Papal States. France in exchange would withdraw her troops within two years from February 1865. Following the convention, the capital was moved from Turin to Florence (1865). Hopes centered on a Roman insurrection, once the French troops had departed (December 1866), but this did not

occur, not even after Garibaldi had almost reached Rome with an army of volunteers in October 1867. Instead, Napoleon III sent back his troops, Garibaldi was defeated at Mentana (November 3), and the French once more garrisoned Rome.

In order to acquire Venetia, the Italian government, encouraged by Napoleon III, entered into an alliance with Prussia against Austria (April 8, 1866). The Austro-Prussian War, which began in June, was entirely successful for the Prussians, while the Italians were defeated by the Austrians on land at Custoza (June 24), and at sea near Lissa (July 20). They resumed the offensive with a considerable army, but were halted by a truce signed between Austria and Prussia (July 26). The Treaty of Vienna (Oct. 3, 1866) sanctioned the cession to Italy of Venetia, which Austria had ceded to France in July. However, the Italian claims to Trentino, Trieste, and Istria had to be abandoned. A plebiscite, held on October 21–22, approved the acquisition of Venetia by an overwhelming majority.

At the beginning of the Franco-Prussian War (July 1870), France began the withdrawal of her garrison from the Rome area, completing the removal of troops by August 19. Urged on by the Left-wing parliamentary parties, and by the Action Party, the Italian government sent an expedition which occupied Rome on September 20. After a plebiscite (overwhelmingly in favor of union with Italy), the annexation of Rome was effected on October 2, and the city became the capital of Italy. The pope's situation was regulated by the Law of Guarantees (May 13, 1871), which gave the pontiff sovereign honors, as well as extraterritorial privileges in the Vatican and Lateran and the summer residence of Castel Gondolfo. A yearly income was assigned to him, and he was to have complete liberty in the exercise of his spiritual ministry. The state renounced all interference in the life of the church, but maintained the exequatur and placet for the destination of ecclesiastical property and the provision of major and minor benefices. The pope did not accept the law, and, considering that he was "placed under hostile domination," shut himself in the Vatican. See also *CHURCH STATES*; *FRANCE—History*; *PEACE TREATIES*; biographies of important figures.

MODERN ITALY

The history of modern Italy may be divided into three major periods: the post-Risorgimento period (1870–1919), in which the country was a liberal monarchy; the period of the rise and fall of fascism and World War II (1919–1945); and the postwar period.

The Post-Risorgimento Period.—With the acquisition of Rome, a national and united Italian state had come into being for the first time in history. The new state was a constitutional monarchy. The king was empowered to nominate and remove his ministers, but it became constitutional practice for him to follow the wishes of Parliament in the choice of the prime minister, in the approval of the list of Cabinet ministers submitted by him, and in the retention or dismissal of the Cabinet. Notwithstanding the respect of the crown for parliamentary suggestions, however, Italy did not have a completely parliamentary government of the British type, with a regular two-party alternative, because

parties and parliamentary groups in Italy were far more numerous and less clearly defined than in Great Britain. Therefore, the king had more initiative in the choice of a government.

In any case, during the first 10 years after the union of Rome with Italy, the division between Right and Left was in practice definite enough to make the formation of a government fairly simple. The Right was substantially a continuation of the government party created by Cavour. It favored restricted suffrage, with a certain tendency to oligarchy and a diffidence in regard to democracy and the popular masses. It believed in the idea of a strong state directing national political life, though respecting existing laws and individual liberty. The Left represented the fusion or mingling of the groups which had opposed Cavour and his successors. While it supported a constitutional monarchy, it had not lost contact with the extreme and tentatively republican elements and showed on the whole a more popular character and a more democratic tendency than the Right. The Left favored an extension of the suffrage and greater freedom in political manifestations. On the margin of this constitutional Left (led by Urbano Rattazzi from 1870 until his death in 1873, then by Agostino Depretis), more radical and republican elements found their place. The pure or Mazzinian republicans remained outside Parliament (Mazzini himself died in March 1872).

The organization of the new state from 1860 to 1873 was accomplished largely by the Right. In order to insure independence and unity, it favored centralization, excluding not only federalism, but also local autonomy. Municipal and provincial administrative elections were held (city mayors were for a long time appointed by the king), but the elected officials had limited powers, and were under the strict control of the prefects. Difficult and tremendous was the government's task in restoring state finances, developing railroads and other public works, and organizing the army and navy.

This program, whereby Italy with notable speed and efficiency approached the status of other major European states, was continued by the Left, which came into power in March 1876. In the 15-year period between 1876 and 1891, elementary education was made compulsory and free (1877); the suffrage was extended from 600,000 to about 3,000,000 persons; railway conventions were signed (1885); landed property was taxed according to its value; communal and provincial administration was reformed; a new penal code was published (1888); the number of army corps was increased from 10 to 12 (1882); and great battleships were built.

During the first years of the government of the Left, Humbert I succeeded Victor Emmanuel II (d. Jan. 9, 1878), and Pope Pius IX (d. Feb. 7, 1878) was followed by Leo XIII. The latter took a firm stand with regard to temporal power, but his language was more moderate than that of his predecessor and for some years he may even have thought of a reconciliation with the Italian government. In any event, Vatican policy was directed toward the restoration of temporal power, and the support first of Germany and then of France was vainly sought. The Leftists continued substantially the ecclesiastical policy of the Right respecting religious freedom and the pope's spiritual independence. At times, however, they displayed weakness in handling the

outbursts of anticlericals, who in turn accused the clericals of provocation. Catholics, on orders from the Vatican, abstained from participation in the political life of Italy.

The Left broke up into various groups which had in part a personal rather than a political character. From 1876 to 1881, Depretis and Benedetto Cairoli governed successively and then formed a Cabinet together; from 1881 to 1887, Depretis remained alone at the head of the government. He introduced a policy known as transformism, which meant the contact and combination in parliamentary majorities and in the Cabinet of elements belonging to the two original parties. But the leadership and the majority of Cabinet appointments remained with the Left, while a section of the Left (especially the so-called Pentarchy, consisting of Cairoli, Giovanni Nicotera, Francesco Crispi, Giuseppe Zanardelli, and Alfredo Baccarini) went into opposition against their former leader.

From the death of Depretis in 1887 until 1896, Crispi was the leading political figure, serving as prime minister in 1887-1891 and 1893-1896, and he continued the policy of transformism. Besides fostering parliamentary expediency, transformism served to unite the conservative elements in defense of the monarchy, for which French influence and the propaganda of the Irredentists for the annexation of Trentino and Trieste (conducted mainly by republicans) were considered dangerous. Against the eventuality of a French attack, Italy concluded, on May 20, 1882, the Triple Alliance (q.v.) with the two authoritarian states of Austria-Hungary and Germany, allied since 1879. The alliance was motivated in part by the French occupation of Tunisia (May 1881), which had a large and prosperous Italian colony.

The alliance was renewed in 1887 (and again in 1891) with better terms for Italy, which received guarantees of German support if the French attempted to move on Tripoli, and guarantees of compensation if Austria advanced in the Balkans. Crispi's foreign policy resulted in tension between France and Italy accompanied by a tariff war. Crispi gave a vigorous impulse to Italian colonial settlement in Eritrea and Italian Somaliland, which were acquired between 1882 and 1890. This African expansion, for which an organic plan and sufficient means were lacking, brought about a conflict with Ethiopia. Italy's defeat at Adua (Adowa) caused Crispi's dismissal (March 1896). He had already been attacked because of his megalomania and his dictatorial and illiberal policy—he dissolved the Socialist Party in 1894—as well as for personal reasons. On Oct. 26, 1896, Italy recognized the independence of Ethiopia by the Treaty of Addis Ababa. (See also ETHIOPIA.)

Under Antonio Starrabba, marchese di Rudini (the leader of the Right, but supported by the Left), an uncertain period followed. It ended with the bread riots of May 1898, which were severely repressed, and in the reactionary policy attempted by the ministry of Luigi Pelloux (1898-1900). Pelloux met resistance from the Extreme Left, and also the Constitutional Left headed by Zanardelli and Giovanni Giolitti.

Following the death of King Humbert I, who was killed by an anarchist on July 29, 1900, the new king, Victor Emmanuel III, called Zanardelli to office (March 1901). This was the beginning of the kingdom's most prosperous period.

The new government adopted a liberal policy in domestic affairs and received extreme Leftist support in Parliament, especially in matters concerning labor organizations. These were allowed to organize and act freely within legal limits, while the government maintained an impartial stand in the conflict between capital and labor. The epidemic of strikes which followed (1901–1902) brought about a better standard of living for the working class, while it did not arrest the full development of Italian economy.

Agriculture flourished following vast land reclamations undertaken through private initiative, production increased, and specialized farming was developed. Income from agriculture advanced from around 3,000,000,000 gold lire in the first years of the kingdom to 8,000,000,000 lire after 1900. The metallurgical industries grew (they were, however, overprotected by tariffs, a matter of serious dispute in the economic field), as did the mechanical and rubber industries, silk production, textiles (from 27,000 looms in 1882 to 78,000 in 1902), sugar refineries, and the production of fertilizers. The electrification of industry made great strides. Joint stock company capital rose from 846,000,000 lire in 1898 to 1,500,000,000 lire in 1903. Foreign trade, which had increased from approximately 2,000,000,000 to 3,000,000,000 lire between 1890 and 1900, reached 5,326,000,000 in 1910. Although the trade balance showed a deficit, this was canceled by the 470,000,000 lire remitted by emigrants and the 450,000,000 lire brought in by foreign tourists (1910 figures). Emigration increased steadily, but a good portion of it was temporary, and the emigrants, in addition to remitting large sums of money, often, especially in the south, returned and invested their savings in land purchases. The budget of 1897–1898 showed the first of a series of surpluses which continued until 1911–1912. The quotations on the public debt rose above par, preparing for the conversion from 4 per cent to 3.75 per cent, which took place in 1906, and for the subsequent conversion to 3.5 per cent. Italian paper money sold at a premium over gold.

Italy's economic progress as a united state was accompanied by manifold and impressive cultural accomplishments. During the second half of the 19th century, literary production was less forceful and original than in the first half, but showed greater variety and was more widely spread, bringing Italy into closer relation with the culture of other European countries. In narrative prose, Giovanni Verga (1840–1922), Antonio Fogazzaro (1842–1911), and Edmondo De Amicis (1846–1908) occupied distinguished places, but the forceful social organism represented by the French novel and even more by the French theater did not have its counterpart in Italy. On the other hand, Italy, as in the past, produced a great isolated personality in the poet Giosuè Carducci (1835–1907), who, besides inheriting the Italian literary tradition, was well versed in foreign philology. Classical in form and conception, his work echoed modern romanticism. Toward the end of the century, the leading place in Italian literature passed to Gabriele D'Annunzio (1863–1938), poet, novelist, and dramatist of European fame and influence. Second to him in influence was Giovanni Pascoli (1855–1912), a poet who, though imperfect in form, echoed new voices celebrating the love of nature and the human soul. The field of philosophical and historical writing

was extremely active, capped by the intense and manifold work of Benedetto Croce (1866–1952). (See also section on *Literature*.)

In the political field, the beginning of the 20th century belonged to Giolitti: he was at the head of the government in 1903–1905, 1906–1909, and 1911–1914. The great majorities which he won in the elections of 1904 and 1909 included the votes of conservatives, liberals, and radicals, so that transformism was again a valid expedient. Giolitti's policy, with all its opportunism, was substantially liberal, but it did not further the formation of organic political parties. The Socialists generally supported his social policy, but declined to take part in the government and split into various factions, among them the revolutionary syndicalists. At the other extreme stood the new Nationalist Party, which was frankly anti-liberal and imperialistic. In this period, for the first time, Catholics shared in the country's political life, supporting the moderates in the elections, and in 1909 a few of them entered Parliament. With the electoral reform of 1912, Giolitti introduced almost universal male suffrage, increasing the electorate from about 3,000,000 to more than 8,000,000.

In foreign policy, Italy steered a somewhat different course, beginning with the downfall of the Crispi ministry in 1896. The Triple Alliance was maintained—it was renewed twice, in 1902 and 1912—but merely as a defensive instrument (particularly with regard to Austria), and the friendship of France was sought. According to an agreement signed in December 1900, France renounced any interest in Tripoli, and Italy in turn held France free to act in Morocco. Later, in 1902, France and Italy reached an agreement whereby the two countries would maintain reciprocal neutrality in case of aggression. Meanwhile, Italy endeavored to halt Austrian expansion in the Balkans. Relations with Austria became strained, the Irredentist movement was once more active, and, in October 1909, the Raconigi agreement with Russia was signed (it provided that both countries would endeavor to maintain the status quo in the Balkans, and that Russia would not oppose Italy's attempt to acquire Tripoli). Through the Italo-Turkish War (1911–1912), Italy was able to annex Libya (Tripoli and Cyrenaica).

When World War I began in July 1914, Italy proclaimed her neutrality (August 3), stating that she was not bound by the Triple Alliance because Austria was an aggressor. She did, however, enter into negotiations with Austria in an attempt to obtain some compensation for Austrian acquisitions in the Balkans. When the Austrian concessions in this regard proved insufficient, Italy turned to the Allies and concluded with them the secret Treaty of London (April 26, 1915). On May 3, Italy denounced the Triple Alliance, and, after a crisis caused by the conflict between the supporters of neutrality (including Giolitti) and of intervention—the so-called *giornate di maggio* (May days)—declared war on Austria-Hungary (May 23, 1915), to take effect on May 24, 1915. Later, on Aug. 27, 1916, Italy also declared war on Germany.

Because of the strategically poor frontier she had inherited from the settlements of 1866, Italy entered the war under difficult conditions, and, in two years, her armies made a net advance of only 10 miles (11 battles of the Isonzo). The Italian Army ended, as Russian resistance was collaps-

ing, by sustaining the entire shock of the Austrian Army augmented by German divisions. Defeated at Caporetto (now Kobarid), on Oct. 24–Nov. 5, 1917, the Italians held firm on the Piave, repulsed a new offensive in June 1918, and finally won a substantial victory at Vittorio Veneto (Oct. 24–Nov. 4, 1918) while the Austro-Hungarian empire broke apart. (See also WORLD WAR I—9. *Italian Front*.)

By the Treaty of Saint-Germain (Sept. 10, 1919), Trentino and Alto Adige (South Tirol) were ceded to Italy. Decisions concerning the frontier with the new state of Yugoslavia (then called the Kingdom of the Serbs, Croats, and Slovenes) were the occasion for bitter controversies concerning Istria, the port of Fiume (now Rijeka), and Dalmatia. The Treaty of Rapallo, concluded directly with Yugoslavia on Nov. 12, 1920, gave Italy all of Istria to the natural Alpine frontier, while Yugoslavia received all of Dalmatia except Zara (now Zadar). Fiume, which had been seized in September 1919 by Gabriele D'Annunzio, was made a free state, but on Jan. 27, 1924, by agreement with Yugoslavia, the city was annexed to Italy. In the general settlements decided at the peace conference in Paris, Italy had little influence; she did not receive any mandates over former German colonies, and only some years later received a modest enlargement of her African colonies (Somaliland, 1925; Libya, 1919 and 1935).

See also WORLD WAR I—15. *Diplomatic History of the War*; 16. *The Postwar World*.

The Rise and Fall of Fascism.—The crisis of May 1915 had put an end to Giolitti's policy of progressive transformism. The war and the disappointments of the peace settlements produced a dangerous state of unrest in Italy, which was aggravated by the propaganda of extremists. The elections of November 1919—the first held with universal male suffrage and proportional representation, and with the last papal ban on Catholic participation lifted—resulted in a victory for the Socialists (156 deputies) and the Populists (Christian Democrats, 101 deputies). The Socialists, who included a wide range of political opinion (the Communists broke away in 1921), supported a series of strikes which culminated in a temporary occupation of industrial plants by the workers (September 1920), and refused to take part in the government though they were the largest party. The Populists, who had attracted a large part of the liberal and conservative votes, followed a middle-of-the-road policy with scant success. New elections, held in May 1921, resulted in 157 seats for the Liberal Center, 108 for the Populists, 123 for the Socialists, 15 for the Communists, and 22 for the Fascists (actually elected in a joint list with the Liberals).

The Fascists, led by a former revolutionary Socialist, Benito Mussolini, found their support in groups without political consciousness, who lacked class feeling and belonged to no political party. They exploited a number of different sentiments and interests, especially the nationalism of the lower middle classes (misled by the nationalistic slogan of a "mutilated" or "betrayed" victory) and the fear of bolshevism on the part of the wealthy. Fascism, aided by the inertia or complicity of the leading classes, fought its opponents with the systematic violence of *squadismo* (squadism, or the use of armed groups to silence opponents), and in the end attempted to seize power by the march on Rome (Oct. 28,

1922). This gesture had little consistency and would have failed had not King Victor Emmanuel refused to proclaim martial law, and, on October 28, sent for Mussolini and commissioned him to form a government.

Mussolini at first maintained a show of constitutional government, although broad use was made of pressure, intimidation, and violence. He was granted dictatorial powers, and, in November 1923, forced a new electoral law through Parliament, providing that the party receiving the largest number of votes would be given two thirds of the seats, which the Fascists received after the election of April 1924. After the murder of Giacomo Matteotti secretary of the United Socialist Party and deputy (June 10, 1924), and the passive anti-Fascist reaction called the Aventine secession (whereby the majority of the non-Fascist third of Parliament abstained, protesting the illegality of the regime—their seats were finally declared vacant in 1926), the Fascists, by means of state and party power, broke the opposition of the remaining political parties and organized a totalitarian state. The Chamber of Deputies, which had first been rendered subservient to fascism, was later, in 1938, replaced by the Chamber of Fasci and Corporations, whose members were appointed by the council of the Fascist Party and the National Council of Corporations. Individual liberty was suppressed, justice was made dependent upon political power, party privilege replaced equal rights among citizens, and the national economy was exploited by profiteers. Italian culture was used for party purposes and vitiated by the spread of gross and inconsistent theories in marked contrast to the fundamental humanistic outlook of modern Italy.

The crown was a necessary accomplice in this work of destruction, because it gave fascism a free hand and repeatedly expressed spontaneous approval of Fascist policy. The upper middle class, especially the so-called plutocracy, also offered the regime its support. In addition, fascism was strengthened by the Lateran Treaty (Feb. 11, 1929), and the Concordat of 1929, by which Pope Pius XI and Mussolini settled the Roman question by creating Vatican City, and by the signing of a concordat favorable to the Holy See.

Fascist foreign policy encouraged nationalist and imperialist aspirations. It supported revision of peace treaties, showed hostility to France and to the League of Nations, and defied the latter by invading Ethiopia (Oct. 3, 1935). Sanctions imposed by the League were ineffectual, Ethiopia was conquered, and, on May 9, 1936, Victor Emmanuel assumed the title of emperor of Ethiopia. Following these events, Italy announced her withdrawal from the League of Nations, in December 1937. On April 7, 1939, Italy invaded Albania, which was rapidly conquered, and five days later, Victor Emmanuel became king of Albania. Mussolini had bound himself to Nazi Germany in October 1936 (Rome-Berlin Axis). He was supported by Adolf Hitler in his policy of intervention in support of Gen. Francisco Franco in the Spanish Civil War, and in his turn he supported Hitler in the German annexation of Austria (March 1938) and of the Sudetenland (September 1938), and in the occupation of Bohemia and Moravia (March 1939), and finally he concluded with Germany a defensive and offensive alliance (May 22, 1939).

At the outbreak of World War II, in Sep-

tember 1939, Mussolini proclaimed Italian nonbelligerence. Then, during the invasion of France, on June 10, 1940, he drew Italy into the war against France and Great Britain; on June 22, 1941, against Russia; and, finally, on Dec. 11, 1941, against the United States. After some initial successes in North and East Africa, Italy underwent a series of reverses, on land, with the loss of all her colonies; on the sea, with the destruction of most of her fleet; and in the air. The general discontent among the Italian people against war and fascism brought about a series of strikes and far-reaching conspiracies among old and new political parties, which formed a clandestine anti-Fascist alliance.

On July 25, 1943, the king dismissed Mussolini and formed a Cabinet of crown dictatorship led by Marshal Pietro Badoglio. An armistice was concluded with the Allies on September 3, but the Germans, who had been permitted to enter Italy in considerable numbers, took possession of northern and central Italy, and Mussolini organized the Republican Fascist Party (September 15) and proclaimed a "social republic" in the north.

Italy declared war on Germany on Oct. 13, 1943, and was recognized by the Allies as a co-belligerent. She took part in the war with regular armed forces, and, to an even greater extent, with partisan action behind the enemy lines. The fighting continued until April 1945, when the country was entirely liberated.

Postwar Italy.—In the political sphere, a beginning had been made to shift control from military to civilian authorities soon after the liberation of Rome. On June 9, 1944, Ivanoe Bonomi formed a coalition Cabinet of anti-Fascist parties; he was replaced on June 17, 1945, by Ferruccio Parri, who himself was forced out on November 24 by Anglo-American pressure. The leader of the Christian Democratic Party, Alcide de Gasperi (1881-1954), then formed his first Cabinet on December 10. The national elections of June 2, 1946, replaced the monarchy with a republic (established June 10) and gave the Christian Democrats a leading position in the new Constituent Assembly. Earlier, on May 9, King Victor Emmanuel III (1869-1947) had abdicated in favor of his son, but the reign of Humbert II was brief and he joined his father in exile after the elections. De Gasperi, a staunch anti-Communist, provided Italy with its strongest postwar government, presiding for more than eight years over a series of coalitions, and steadfastly pursuing a policy of close cooperation with the West. In the critical elections of April 1948 (the first held under Italy's republican constitution, effective January 1), he was established firmly in power by a decisive victory over the Communists; and on May 11, Parliament selected Luigi Einaudi as first constitutional president.

In the field of international relations, the main postwar problem of Italy was that of its adjustment to the conditions created by the peace treaty of Feb. 10, 1947. The treaty's provisions included the surrender of Istria to Yugoslavia (except for the Free City of Trieste), the renunciation of all titles to the African colonies, and reparations payments totaling \$360,000,000 to the Soviet Union, Greece, Ethiopia, and Albania. Other clauses severely limited land, naval, and air forces. These provisions were substantially mitigated and in many ways obliterated by subsequent developments which led to Italy's participation in the Marshall Plan (June 1947),

the North Atlantic Pact (April 4, 1949), the Council of Europe (May 5, 1949), and the Western European Union (October 1954). The Trieste (q.v.) problem was solved by an agreement signed in London on Oct. 5, 1954. Italy was admitted to the United Nations on Dec. 14, 1955, and became a founding member of the European Economic Community (Common Market) in 1957. In succeeding years the Italian government favored expansion of the Common Market and greater European political unity.

The political situation in Italy was often chaotic in the 1950's and 1960's. Italy's multi-party system prevented any party from securing a majority in parliament. As a result the Christian Democrats, in ascendancy since 1945, sought alliances with other center and left-center groups to form coalition governments. Their efforts were complicated by their division into right and left wings and by the large Communist Party vote in parliament.

De Gasperi's government fell in 1953. Christian Democratic premiers rapidly succeeded one another thereafter. Governmental crises were even more frequent than the rotation of premiers indicates. Often the premier had to form several different cabinets during his term in office. There were periods with no cabinet at all and periods with temporary "caretaker governments."

POSTWAR PREMIERS OF ITALY

Alcide de Gasperi	Dec. 1945 to Aug. 1953
Giuseppe Pella	Aug. 1953 to Jan. 1954
Amintore Fanfani	Jan. 1954 to Feb. 1954
Mario Scelba	Feb. 1954 to June 1955
Antonio Segni	June 1955 to May 1957
Adone Zoli	May 1957 to June 1958
Amintore Fanfani	June 1958 to Jan. 1959
Antonio Segni	Feb. 1959 to Feb. 1960
Fernando Tambroni	March 1960 to July 1960
Amintore Fanfani	July 1960 to June 1963
Giovanni Leone	June 1963 to Nov. 1963
Aldo Moro	from Nov. 1963

Governmental continuity was maintained through the office of the president, who is elected for a fixed 7-year term. Luigi Einaudi, the first president, was succeeded by Giovanni Gronchi in 1955. Antonio Segni succeeded Gronchi in 1962. Segni resigned because of ill health in 1964, and was succeeded by Giuseppe Saragat.

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4. LANGUAGE. We shall discuss in this article two main questions: how the numerous dialects spoken in modern Italy grew out of Latin, and how the Tuscan dialect took precedence over the others and became the Italian language. First, however, we must set the linguistic boundaries of our inquiry and mention such peripheral variations as the Sardinian and Latin dialects.

Linguistic Boundaries.—The area in which Italian dialects are spoken and standard Italian is the accepted legal and literary language coincides for the most part with the territory of the Italian Republic. The following are the principal exceptions to this general rule.

Non-Italian Areas in Which Italian Dialects Are Spoken.—The dialects of Corsica are of the Italian type, but the official language and that taught in the schools is French. The Ligurian dialect, strongly influenced by Provençal, is current in several French border villages and in the principality of Monaco.

In Switzerland, Lombard dialects are spoken, and standard Italian is the official language of the canton of Ticino and the valleys of Mesocco (Mesolcina), Bregaglia, and Poschiavo of the canton of Graubünden (Grisons).

The majority of the people of the Free Territory of Trieste are Italians. Italian dialects of

the Venetian and archaic Istrian types are spoken in western Istria, which is part of Yugoslavia. Venetian dialects are also spoken by sizable minorities in the cities of Dalmatia and by a small group of Jews on the island of Corfu.

In the Republic of San Marino, dialects of Romagna are spoken, and Italian is of course the official language. Until 1934, Italian was used in the schools and courts of Malta on an equal footing with English, and about one sixth of the people on the island speak Italian. Finally, Italian is used extensively in the former Italian possessions in Africa and by Italian immigrants all over the world.

Italian Areas in Which Non-Italian Dialects Are Spoken.—There are in Italy a number of "peninsulas" (areas contiguous to foreign countries across the Alps) and "islands" where languages other than Italian are spoken. French dialects of the Franco-Provençal and Provençal groups (see *PROVENÇAL LANGUAGE*) are spoken in approximately 70 communes of Valle d'Aosta and in several valleys of western Piedmont where the Waldenses (q.v.) are established. Mid-14th century Waldensian migrations created two Franco-Provençal villages in the Province of Foggia, in Apulia, and one Provençal village in the Province of Cosenza, in Calabria.

German dialects are spoken by a majority of the people of the Alto Adige (South Tirol), but in some sections there are sizable Italian minorities, and in four valleys Ladin is spoken. Other small German-speaking groups, some of long standing, are scattered along the Alps from Monte Rosa in the west to the Carnic Alps in the east. They include in all no more than 9,000 persons.

There are a few Slovenes in the eastern part of Friuli, and a Croat "island" of three villages in the Province of Campobasso, in Molise. In southern Italy we find 47 Albanian-speaking villages, founded by Albanians who fled across the Adriatic during the wars of Scanderbeg (q.v.) against the Turks in the mid-15th century.

Greek is spoken in 13 villages grouped in two small areas at the extreme southern point of Calabria and near Lecce in Apulia. At Alghero, in Sardinia, the language is Catalan.

Inter-Italian. Linguistic Migrations.—At Carloforte, on the tiny island of San Pietro west of Sardinia, a Ligurian dialect is spoken, and several villages in Sicily were founded by Lombards who came south from the valleys of Lago Maggiore between the 11th and 13th centuries.

Sardinian, Ladin, and Dalmatian.—There are two groups of dialects (the last trace of a third disappeared at the end of the 19th century) spoken along the borders of Italy, which without actually belonging to the Italian group are closer to it than they are to any of the other Romance languages.

Sardinian.—The dialects of Logudoro (north central Sardinia) and Campidano (southern Sardinia) have a conservative character all their own. In contrast to Italian, they retain the hard sound of the Latin *c* before *e* and *i*: Latin *decem*, Sardinian *deghe*, Italian *dieci* (ten); Latin *dulcis*, Sardinian *dulke*, Italian *dolce* (sweet). Final *s* is also retained: Latin *tres*, Sardinian *tres*, Italian *tre* (three); Latin *facis*, Sardinian *faghes* (you do or make). The definite article in Sardinian is *su*, *sa* (plural: *sos*, *sas*), derived from the Latin *ipse*, *ipsum* (self). All the other Romance languages except the Catalan spoken in the Balearic Islands have definite articles taken

from the Latin *ille, illud* (that). Although Sardinian was formerly used in official papers and is a vehicle in folk literature, it has never been a literary language.

Ladin.—Three groups of Rhaeto-Romanic languages—the first in the Swiss canton of Graubünden; the second in several valleys of the Dolomites in Venezia Tridentina (Val Gardena, Val Badia e Marebbe, Val di Fassa, and Livinalongo); the third covering Friuli around Udine (and formerly Trieste)—were scientifically studied and first described as an independent linguistic unit under the name of Ladin by Graziadio Ascoli (q.v.) in 1873. (Strictly speaking, the name Ladin applies to only one of the Graubünden types.) Other scholars prefer the general term Rhaetian or Rhaeto-Romansh.

Even scholars who maintain that these dialects are a single unit consider their unity to be of a negative or passive kind. They are similar not in the active development of common characteristics, but in their retention of archaic traits and their refusal to accept innovations stemming from Italian dialects. The most widespread characteristic of the Ladin dialects is the palatalization of the *ca* group: as in Latin, *calida*; Ladin *cauda*, *çada*, *çada*; Italian *calda* (warm).

Friuli has a minor literary tradition, and the canton of Graubünden has produced a considerable body of verse and prose since the 16th century. In 1937, Romansh was recognized as a fourth national language by the Swiss Parliament, although it was not admitted to the official status of German, French, and Italian.

Dalmatian.—Dalmatian was spoken in the Middle Ages in the coastal cities of Dalmatia. It has been extinct for a fairly long time—in Dubrovnik (Ragusa), for example, since the end of the 15th century. Antonio Udina, the last man to speak Veglioto, the local Dalmatian dialect of Krk (Veglia), died in 1898.

Latin vowels change in Dalmatian to diphthongs—Latin and Italian *capra*, Veglioto, *kuobra* (goat)—but consonants have been retained. Here, as in Sardinian, *ce* is hard: Latin *cena* (supper), Italian *cena* (palatal), Veglioto *kaina*.

Italian Dialects.—Italian dialects differ more among themselves and from the standard language than those of any other country. So great are the differences that a Piedmontese and a Sicilian who knew only their own dialects would have great difficulty in understanding each other. Despite these differences between the dialects of one end of the peninsula and the other, however, there are very few cases of sharply drawn dividing lines between one dialect and another geographically adjacent to it. Different words and grammatical constructions cover areas which coincide only partially, if at all, with other factors. For these reasons, the classification of Italian dialects is in great part arbitrary and dependent upon nonlinguistic criteria. Keeping this point in mind, we may list the following groups.

Gallo-Italian Dialects.—This group includes dialects belonging to the following subdivisions: Piedmontese, Ligurian, Lombard, and Emilian. Each corresponds roughly to the region of the same name. We say roughly because Lombard, for example, not only includes the dialects of the Swiss canton of Ticino and the three Italian valleys of the canton of Graubünden, but is carried over into the dialects of western Trentino. Moreover, Voghera, Pavia, and Mantova, which be-

long administratively to Lombardy, have dialects of the Emilian type.

Generally speaking, the Gallo-Italian dialects closely resemble French dialects, particularly those of the Provençal group. Piedmontese, Ligurian, and Lombard have the mixed vowels *ü* and *ö*, while Emilian has only *ü*. They almost all drop final vowels, except for *a*: Latin *septe* (*m*), dialect *set*, Italian *sette* (seven); Latin *octo*, dialect *ot*, *vot*, *öt*, Italian *otto* (eight).

Venetian Dialects.—These dialects fall into three subdivisions: Venetian proper, Trentino, and Istrian. Their lack of mixed vowels and retention of final vowels brings them closer to Tuscan usage than to that of the Gallo-Italian group. On the other hand, Gallo-Italian affinities are seen in the substitution of the voiced for the voiceless stop—as in *séda*, Latin *seta*, Italian *seta* (silk)—in the reduction of a double to a single consonant—*sète*, Latin *septe* (*m*); *òto*, Latin *octo*—and in vocabulary.

Tuscan Dialects.—This group has the greatest historical importance, since it became the basis of standard Italian. Cultivated Florentine speech is almost identical with the standard written language, although we may note the recent reduction of the diphthong *uo* to *o*—*bòno*, *còre*, instead of *buono* (good), *cuore* (heart)—and the aspirate pronunciation of guttural *c*—*amerihano* instead of *americano* (American). The latter does not occur, however, when *c* follows another consonant, as in *barca* (boat) and *panca* (bench). Vernacular Florentine speech has several characteristics of its own. There are also quite a few variations from cultivated Florentine in the popular spoken language of northwestern Tuscany (Lucca, Pisa) and southeastern Tuscany (Siena, Arezzo).

If we compare Tuscan with other Italian dialect groups in regard to its fidelity to Latin, we find it almost always more conservative. It has few peculiar deviations from Latin: let us look, for example, at the changes in the Latin ending *-ariu* (*m*), as in *Januariu* (*m*) and *librariu* (*m*). In northern and southern Italy, except for some later changes, it is pronounced *-aro*; only in Tuscany (and Umbria) do we find *-aio*, as in *gennaio* (January) and *librario* (bookseller).

As might be expected from its geographical position, Tuscan is often midway between northern and southern forms. The definite article, for example, in the north is usually of the *el* type, and in the south of the *lo* or *lu* type. In Tuscan both forms are used, depending upon the noun: *il libro* (the book); and *lo stato* (the state). In northern Italy the past indefinite (*ho fatto*, have done or made) is used rather than the past definite (*feci*, did or made) current in the south, while Tuscan assigns to each a separate use. Such compromises helped to bring about the adoption of Tuscan as the standard language.

Corsican Dialects.—In their modern form, Corsican dialects are very much like Tuscan, but beneath the surface there are traces of an archaic phase in which they must have resembled Sardinian. The dialects of northern Sardinia, both the Sassari type and that of Gallura, are closely akin to the Corsican.

Central Italian Dialects.—The dialects of northern Latium, Umbria, and Marche form a compact group in which characteristics of the south are visible. (This is particularly true of the central region around Ancona, since Pesaro is closer to the Emilian dialect, and Ascoli to

the Abruzzan.) Over a wide area a distinction is made between Latin endings in *o* and *u*.

Southern Dialects.—These include the dialects of southern Latium, Abruzzi, Campania, Calabria, Apulia, and Sicily. Throughout this area and in part of central Italy, we find Latin *nd* changed into *nn* (Latin and Italian *quando*, dialect *quannë*, when) and *mb* into *mm* (Vulgar Latin *camba*, Italian *gamba*, dialect *gammna*, leg). Somewhat restricted to the south is the change of *pl* to *kj* (Latin *plus*, Italian *più*, dialect *kju*, more), and even more restricted (but interesting because it is found also in Corsica) is the change of *ll* to *dd*, a *d* sound pronounced with the tip of the tongue far back in the mouth (Latin and Italian *bella*, dialect *bedda*, beautiful). In the far south (Calabria, southern Apulia, and Sicily) the accented Latin vowels *i* and *e* appear as *i* (Latin *pilu*[*m*], Italian *pelo*, dialect *pilu*, hair; Latin and Italian *tela*, dialect *tila*, cloth), and the vowels *ü* and *ö* as *u* (Latin *ingulm*], Italian *giogo*, dialect *jugu*, yoke; Latin *spo*[*n*]*su*[*m*], Italian *sposo*, dialect, *spusu*, spouse).

Dialectal Diversity and Origins.—In order to give some idea of the complex differences among the Italian dialects, here are four versions of a passage from the *Decameron* (*First Day, Ninth Tale*), preceded by an English translation printed in 1620:

English Version: "Sir, I presume not into your presence, as hoping to have redresse by you, for divers dishonourable injuries done unto me; but, as full satisfaction for them, doe but teach me how you suffer such vile abuses, as daily are offered to your selfe. To the end, that being therein instructed by you, I may the more patiently beare mine owne."

Original Text, Florentine of the 14th Century: "Signor mio, io non vengo nella tua presenza per vendetta che io attenda della ingiuria che m'è stata fatta, ma, in sodisfacimento di quella, ti priego che tu m'insegni come tu sofferi quelle le quali intendo che ti son fatte, acciò che, da te apparando, io possa pazientemente la mia comportare."

Turin: Sgnor, i véno nen ant vostra presensa pèrch'i spera d'otnine vendèta dèl'ingiuria ca m'an fame; ma, per chi pòsa soportella, i v' prego de mostreme com i feve a tolerè cule ch'i sento ch'a fan a voi, pèrchè, 'mparand da voi, i pòsa soportè pasientement la mia."

Bologna: "Sgnour mi en t' pinsar ch'at seppa vgnò dinanz perchè t'fagh el mi vendè del'inzuri, ch'm'ein sta fatti da zert galiut, ma in scambi d' quelli a pregh bèn ch' t' m'insegn almanch, cum t' fa a supurtar quelli, cha intènd, ch' t' ein fatti dal zèint alti: aziò ch'a possa imparar d' guernarom, e d' supurtar anca me la mi cun pazenzia."

Palermo: "Maistà, iu nun vègnu a la tò prisenza pirchi m'aspettu giustizia di l'offisa ch'haju avuta fatta, ma pri prigarivi di 'nsignàrimi comu soffritti tutti l'offisi ch'i iu haju 'ntisu diri chi vi fannu, acciuchhi, 'mparannu da vui, putissi iu cu pacenza supurtari la mia."

What are the reasons for such conspicuous differences? Linguists offer us three distinct explanations. According to the substratum theory, many differences are due to the fact that as the Latin language spread through Italy with the Roman conquests it was adopted by peoples of other stocks and languages, who pronounced it according to their own ways of talking and began to modify it. Changes would have taken place, then, either immediately, when the various peoples first learned Latin or later, when the decline of the Roman Empire and its cultural influences paved the way for mutations. The substrata which appear to have had the strongest influence were the Celtic (on the Gallo-Italian dialects) and the Osco-Umbrian (on the central and southern dialects). Tuscany, however, seems to have been practically immune to the influence of the Etruscan substratum.

According to the superstratum theory, much change is due to the Germanic invasions which

brought about the fall of the Roman Empire. But while everyone recognizes a strong Germanic influence on the Italian vocabulary, phonetic and morphological influences are highly debatable.

The third theory is based on the development of local patriotism at the height of the Middle Ages, and particularly during the era of the Italian communes. This theory is substantiated by the fact that many of the differences found in modern Italy do not occur in the earliest texts and appear to have had a late origin.

There is no essential contradiction in these theories. We need only establish in what measure each of the three influences contributed to the changes that took place.

Standard Italian.—Latin remained the only written language for many centuries after it was no longer spoken and had been transformed in the former Roman provinces into a variety of dialects. Very gradually, in the countries which were to belong to the Romance language group, the spoken language crept into writing. The requirements of written language and the example of Latin prevented the development of writing in outright dialect form. On the contrary, there was an effort to eliminate terms that were too colloquial and to refine and broaden the dialect—in short, to make it into a language.

Except for a riddle written in Verona in the 9th century (which we cannot be sure the author intended to write in the vernacular rather than in Latin), the earliest examples of sentences written in the vernacular come from four documents written in the principality of Benevento between 960 and 963, referring to properties of monasteries connected with Monte Cassino. These sentences were prepared statements for witnesses on the stand. The first runs: "*Sao ho kelle terre, per kelle finì que ki contene, trenta anni le possette parte Sancti Benedicti.*" ("I know that the land within the boundaries mentioned here has been for 30 years among the possessions of St. Benedict.")

There are few other examples of vernacular writing until the early part of the 13th century, when a courtly form of lyric derived from a Provençal model appeared at the court of King Frederick I of Sicily (Emperor Frederick II). Though quite cold and conventional in feeling, this type of poetry is extremely important as the earliest example of Italian lyric verse. Unfortunately, we lack a thorough acquaintance with the language of the poets of the Sicilian school because their manuscripts were copied in Tuscany at the end of the 13th century and extensively altered. We can reconstruct the original Sicilian dialect to some degree only by studying the rhymes.

There was an attempt made in the 13th century to create a literary language in Bologna, seat of one of the most important medieval universities. During the second quarter of the century, Guido Fava (c.1190–c.1243) published *Gemma purpurea*, a collection of model letters written under various circumstances by imaginary characters. The purpose of the letters was practical, but their style aimed at a certain elegance. In the same period, Guido Guinizelli or Guinicelli (q.v.) wrote half-amorous, half-philosophical lyrics which are highly important in the development of the language, although here too the existing texts are none too exact. Guinizelli's example and the humble efforts of poets in Lucca, Pisa, and Arezzo came to a climax when Dante

Alighieri (q.v.) and his contemporaries created the *dolce stil nuovo* (sweet new style).

A number of circumstances combined to give Florence in the period from the end of the 13th century through the first half of the 14th century a privileged position among the cities of Tuscany, and indeed of all Italy. Speaking of its political influence, Giovanni Villani (1280?–1348) said that Florence, originally an offshoot of Rome, had begun at this time to rise while Rome was in decline. Other factors were the growth of commercial enterprises trading with all of western Europe, and the extraordinary flowering of the arts which accompanied the building of Santa Maria del Fiore (begun c. 1298) and the Palazzo Vecchio. Dante, who in the *Divina Commedia* sang of earthly passions and heavenly bliss, and in *Il Convivio* wedded prose to the subtleties of scholastic thought, won immortality for the language in which he wrote. The Florentine tongue, which in the 13th century had been the humble vehicle of commercial registers, chronicles, the rules of confraternities, and translations, was now the basis for literature of every kind. In the following generation, Petrarch (Ital. Francesco Petrarca) and Giovanni Boccaccio (q.v.) continued the Florentine tradition. The subtle analysis and veiled melancholy of Petrarch's *Il Canzoniere* and the exuberant tribute to the man's ingeniousness of Boccaccio's *Decameron* made with the *Divina Commedia* a perfect three-sided picture. Different as the three writers were, their common greatness was such as to inspire a host of followers to use the Florentine vernacular and to withstand the humanist attempt in the 15th century to reinstate Latin as a literary language.

Books were printed in Italian for the first time in 1470. Within three years, along with the Bible and a very few other works, there were three editions of *Il Canzoniere*, three of the *Decameron*, and three of the *Divina Commedia*. The introduction of printing marks a decisive period in the history of the Italian language. Previously, in northern and southern Italy alike, each author had written as best he could, striving to dignify his native dialect with the aid of Latin and occasional reference to such Tuscan writings as might have come his way. Now the advent of printing made it plainly necessary for Italian, as well as Latin, to acquire uniformity. The printer's work reached readers in various parts of the peninsula, and he could not offend their taste with an excess of dialectal usages. Moreover in this same period national states were developing in other parts of Europe: in Spain with the union of Castile and Aragon (1479) and the expulsion of the Arabs (1492); in France with the triumph of Louis XI (r. 1461–1483) over feudal individualism and the annexation of Brittany (1491). In Italy the time was not yet ripe for political unification, but in the 16th century a considerable degree of linguistic unity was attained. This unity was accomplished by literary influences, that is, by imitation of the three great writers of the 14th century. Such imitation was recommended particularly by Pietro Bembo (q.v.), a Venetian who held undisputed sway over the fields of literature and linguistics in the early part of the 16th century. Tuscan as well as northern writers followed the rules which he laid down in 1525 in his *Prose della volgar lingua*. Writers of the south, too, tended to imitate the great 14th century models, as is shown in the

work of Jacopo Sannazaro (q.v.), author of *Arcadia* (1504).

To what extent did the three great Tuscan writers influence the progress of linguistic unification? The following metaphor may give an idea. Imagine a forest where for several centuries hundreds of plants of the same species but of different varieties have reproduced themselves spontaneously without human interference. Then suppose that a horticulturist comes along, chooses the best variety, and grafts it on all the rest. If we compare the spontaneous growths to all the dialects of Latin origin, and Tuscan to the variety chosen for grafting upon the others, we shall see what happened in Italy in the 16th century.

A number of phonetic characteristics show that modern standard Italian grew out of the Tuscan, or rather the Florentine, dialect. We saw that in both northern and southern Italy the Latin ending *-ariu(m)* changed to *-aro*, while in Tuscany it became *-aio*. Moreover, closed *e* and *o* in certain positions (before palatal *gl* and *ng*) changed only in Florence and its immediate neighborhood to *i* and *u*. If dialects from various regions had combined to make Italian, or if another Tuscan type, such as the Sienese, had prevailed, then we should say *fameglia* instead of *famiglia* (Latin *familia*, family), and *lungo* instead of *lungo* (Latin *longus*, long). Nevertheless, we must remember that in the 16th century the matter did not yet appear to be definitely settled, and innumerable disputes raged about what was called the *questione della lingua* (language question).

The position of Tuscan as a literary language was consolidated by an institution founded in 1582 which exercised for some time a considerable influence: the Accademia della Crusca (literally, Academy of the Bran, or Chaff). This name, originally somewhat of a joke, soon came to be considered symbolic of the academy's chief task, that of distinguishing between good language and bad, in the same way that wheat is separated from chaff. In 1612, the academy published the first great historical and grammatical dictionary of a modern language. This dictionary was imitated in other countries for two centuries thereafter.

The general trend of the 18th century dominated by Enlightenment and French influence, lessened the literary and linguistic sway of the classics. In the early 19th century writers wavered between a ponderous imitation of 14th or 16th century language and a loose style containing many Gallicisms. The two editions of Alessandro Manzoni's celebrated novel *I promessi sposi* (1825–1827 and 1840–1842) constitute what may be called a linguistic manifesto. (See BETROTHED, THE). The great Milanese romantic writer insisted on using a live, modern language patterned not on mere imitation of the past, but on the contemporary usage of the city of Florence. Thereafter, the course of the Italian language followed the political developments which led to the formation of the Italian nation and its life as a single political unit. Commercial and cultural exchanges increased, and the standard language became more uniform.

The formation of standard Italian took place in a different way from that of other major languages. Literature, as we have seen, was the chief factor in its evolution, rather than the extension of royal government, as was the case in France, or the translation of the Bible and the

influence of the usage of the imperial chancery, as in Germany. This explains why it was so difficult for Italian to take definite shape. It achieved uniformity only after long struggles between various stylistic ideals, and this meant strong divergencies in both vocabulary and grammar. For this reason, modern Italian retains a number of legitimate variations of usage. We may say *danaro* or *denaro* (money); *obiettivo* or *obbiettivo* (objective); *patriota* or *patriotta* (patriot); and *soprintendere*, *sovrintendere*, *sopraintendere*, or *souvaintendere* (superintend). Many grammatical rules, too, are optional. We may use either *pomodori* or *pomidori* as the plural of *pomodoro* (tomato), and the forms *io ho visto i libri* and *io ho visti i libri* (I have seen the books) are both equally correct.

The struggles over usage, grouped together as the *questione della lingua*, were particularly sharp in the 16th and 19th centuries. First there was much discussion on what precisely the Italian language should be and whether the prevalent tongue should be called courtly or vernacular, Florentine, Tuscan, or Italian. In the first half of the 19th century controversy centered about the 14th century revival proclaimed by Father Antonio Cesari (1760-1828); in the second half about whether literary language should conform to the usages of the cultivated Florentine, as Alessandro Manzoni proposed. The constant patterning of the Italian language on literary models is due to the highly developed individuality of the Italian people and their strong aesthetic sense. Moreover, literary influence came to predominate on a large scale because, after the modest beginnings of its literary history, Italy produced three writers of the stature of Dante, Petrarch, and Boccaccio.

We must add a word about the stability of Italian grammatical forms. Italian never underwent changes so great as to upset its phonetic system; there was no mutation in vowel sounds such as took place in both French and English up to comparatively recent times. Here, then, we have the most striking characteristic of Italian as compared with other languages, its longevity. In France an understanding of the 11th century *Chanson de Roland* requires the study of what is almost a foreign language, and even writers of the 16th century use forms that are considered archaic today. The same is true of English, German, and Spanish. But the average modern Italian, although the meanings of some words and constructions may escape him, can still feel that his language is that of Dante.

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5. LITERATURE. From the Earliest Times to Dante.—The writing that was done in Italy from the fall of the Western Roman Empire to the beginning of the 13th century was Latin; it belongs to a period of transition from Roman literature to Italian literature, and it was European rather than Italian in scope. Its chief

subject was philosophy, especially scholastic philosophy, and such purely literary works as were written were of inferior caliber. A study known as *ars dictandi* (art of composition), which aimed at setting up standards in the literary field (more exactly, in letter writing), began at Monte Cassino in the 11th century and was elaborated in a number of treatises even beyond the 13th century. These treatises showed no trace of the classical spirit, which continued to be lacking until Dante revived it.

Among the literary documents of this period we may recall the *Chronicon Novaliense* (first half of the 11th century), a crudely but vigorously told cycle of legends, and the 12th and 13th century verses of the wandering students or jesters known as the goliards, which broke out in every country of Europe (see GOLIARD). The tone of these verses was sensual and anticlerical, and they were written in rhythmical meter. The use of rhythmical meter and the development of the Italian language are milestones in the separation of Italian from Latin literature.

The first literary documents in popular Italian date from the 13th century; they consist largely of religious poetry and that of the so-called Sicilian school. Among the religious poems of the time are *De Jerusalem celesti* and *De Babilonia civitate infernali* by Giacomino da Verona (fl. second half of the 13th century); the *Libro delle tre scritture* of Bonvesin da la Riva (1240-1315), containing a vivid description of the torments of hell; *Il cantico del sole*, or *delle creature* (see CANTICO OF BROTHER SUN, THE), of St. Francis of Assisi (1182-1226), which set the tone of the tender and spontaneous ascetic prose of the 13th to the 15th century; and the *laudi* (hymns of praise) of the Franciscan monk Jacopone da Todi (c. 1230-1306), reputed author of the *Stabat Mater* (q.v.), which range from the heights of mystical ecstasy to the depths of despair and are, despite their faults, expressions of the most powerful Italian poetical genius before Dante. The Sicilian school, which centered about the court of King Frederick I of Sicily (Emperor Frederick II, q.v.) in the first half of the 13th century, was an offshoot of Provençal poetry and celebrated a somewhat conventional courtly love. The leaders of this school were Giacomo da Lentini or Lentino, Giacomino Pugliese, and Guido delle Colonne. Other poets were Rinaldo d'Aquino and Odo delle Colonne, who wrote two spontaneous popular poems. Also in the popular vein is *Rosa fresca aulentissima*, a sprightly tale of a lovers' quarrel by another Sicilian, Cielo d'Alcamo (fl. mid-13th century).

Epics wrought of Carolingian, Breton, and classical material in Franco-Venetian verse or Italian prose occupy a secondary place, together with such moral allegories as the *Fiore*, *Li Livres dou Trésor* (in French prose) of Brunetto Latini (1212?-1294), and the same writer's *Il Tesoretto*, in seven-syllable verse. Of distinct value is *Il Milione* (tr. into English as *The Book of Marco Polo*), a fabulous narrative of Polo's travels through Asia as told to Rustichello da Pisa and written in a mingled French and Italian prose.

Several Tuscan poets of the transitional period stem from the Sicilian school, among them Guittone d'Arezzo (c. 1230-1294) and Chiaro Davanzati (fl. second half of the 13th century). Superior to them were the poets of the *dolce stil nuovo* (sweet new style). This school begins

with Guido Guinizelli or Guinicelli (1240?-1274). Its leaders were Dante Alighieri and Guido Cavalcanti (c. 1250-1300) of Florence, and a later follower of less importance was Cino da Pistoia (Guittoncino de' Sinibaldi, 1270-1336). Their poetry is idealistic with psychological overtones and is influenced by religion and philosophy. The chief subject is the angelic woman, described by Dante as "*venuta di cielo in terra a miracol mostrare*." Beside these idealistic lyrics are examples of realism and satire, best represented by Cecco Angiolieri (1250?-1312) of Siena, the author of many sonnets, of which the most famous is a curse on the entire world, including his own father and mother.

The prose of this period is simple almost to the point of being elementary; translations from the Latin were only just beginning to nourish and invigorate its syntax and capacity for expression. It deals with the details of city life, adventures culled from the Breton cycle, and moral reflections. The best prose is to be found in *Il Novellino*, a collection of biblical, classical, and medieval stories, told in short sentences and occasionally displaying real talent in pinning down the salient features of an event or a character. In the *Tavola rotonda* we find a more complex style and in certain passages a feeling of epic solemnity. Little originality is to be found in *Il libro dei Sette Savi*, *I conti di antichi cavalieri*, or *I fatti di Cesare*.

Dante.—With Dante a new spirit enters into the favorite themes of medieval literature and the echoes of classical antiquity. He was by nature vigorous and prone to synthesize; his art he learned from Vergil and his disciplined thinking from St. Thomas Aquinas. Dante Alighieri was born in Florence in May 1265. The most influential events of his life were his love for Beatrice (c. 1289) and the exile imposed upon him on Jan. 27, 1302, by the Neri (Black) faction of the Guelphs (q.v.), who, supported by Pope Boniface VIII, prevailed at this time over the Bianchi (Whites). After many wanderings the poet died in exile at Ravenna in 1321. Dante's love for Beatrice inspired *La Vita Nuova*, a youthful volume of poems and prose pieces whose heroine is celebrated in terms even more idealistic than those of the *dolce stil nuovo* and is promised the dedication of another and loftier work, the *Divina Commedia* (see DIVINE COMEDY).

In the *Divina Commedia* the themes of love and politics are mingled. Beatrice saves Dante from a life of sin and leads him, first through the intermediary of Vergil and then herself in person, through hell, purgatory, and paradise to the contemplation of God, while at the same time we have projected into the three realms of the after-life a picture of the spiritual and political life of the poet's time. The power of this masterpiece lies, then, in its depiction of Dante's own world as seen from beyond the grave. Other periods of history are involved, but only sporadically and as forerunners of the events of Dante's lifetime. Dante saw the world around him as ill governed because of the evil ways of the church and the abandonment of Italy by the Holy Roman Empire. It is plain in various parts of the poem that exile contributed to his pessimistic views and made him a scornful judge of his own times and a prophet of dire things to come.

This work, which he called simply the *Commedia* (the adjective *Divina* was added later) is, as we have seen, the story of Dante's spiritual

purification in the course of an imaginary visit to the next world, accomplished through his contact with the inhabitants thereof, so that the poet is seen among the passions, struggles, and civilization of his age. The broad scope of the poem derives from its double meaning as an autobiography and the spiritual history of a period. Dante himself, who is vigorously portrayed, undergoes a change as he moves from region to region of the afterlife. In the *Inferno* he is an enemy of those whom he meets and an implacable judge. In the *Purgatorio* he turns inward and meditates as he walks in brotherly fashion beside the thoughtful souls who dwell there. In the *Paradiso* he rises above all earthly passions. Each region has an individual coloring, which is reflected in its physical background and the characters who people it, as well as in the frame of mind of the poet. Quite naturally, then, the characters of the *Inferno* are the most powerfully drawn, attached as they still are to the sinful passions that brought about their damnation. The souls of the *Purgatorio*, torn between their earthly sins and their desire for expiation, no longer live in mutual hate and enmity but are bound by a new feeling of brotherhood. In the *Paradiso* individuals lose their identity and are made one in a chorus of harmony and praise. The landscape of the *Inferno* is dark, rough, and fearsome; that of the *Purgatorio*, isolated in the ocean, is calm and invites to meditation; the *Paradiso* is laid among ever-widening and more luminous vistas of the heavens.

This is the general layout of the poem. If it had been rigidly maintained the result would have been methodical to the point of monotony, but, as it is, every now and then the pattern is broken. The damned are portrayed with sympathy, affection, and even admiration, for grave sins, after all, may be caused by humanly comprehensible motives; they may go hand in hand with great qualities or be essentially pitiful and tragic. Thus we have in the *Inferno* such figures as Francesca da Rimini, Brunetto Latini, Ulysses, and Ugolino della Gherardesca (qq.v.), and Farinata degli Uberti. The meditative pages of the *Purgatorio* are interrupted by the political invective of Canto VI and the reproaches and prophecies of Canto XIV. In like fashion, the bliss of the *Paradiso* is broken by the satire directed at degenerate religious orders and St. Peter's wrath at corrupt holders of the papacy. There is immense variety in Dante's poetry, especially in the *Inferno*, which is the richest of the three parts, while the *Purgatorio* is the smoothest, and the *Paradiso* most nearly touches the summits of sublimity. In its structure and balance the poem is a model of architectonic solidity; it is also one of the most imaginative and many-sided productions of world literature.

While he wrote the *Commedia*, Dante was working on *Il Convivio* (*The Banquet*), and some pages of the latter are permeated with the elevated and sorrowful feeling of the poem. *Il Convivio* is unfinished; it was intended to be a sort of encyclopedia of philosophy, a banquet of philosophical ideas served up to the unlearned. It is made up of four treatises—that is, an introduction and three commentaries, each accompanied by a poem—containing discussions of morals, politics, metaphysics, and astrology. Many passages are commentaries on the poetical interludes, and the style, which is far removed from the dreamy tone of *La Vita Nuova*, displays the manliness

and maturity of the author of the *Commedia*.

Important for Dante's poetical theory and for the history of Italian literature, language, and versification is *De vulgari eloquentia*, a Latin work broken off at Chapter 14 of the second book. In the first book, Dante speaks of the origin and history of the Italian language; he derives Italian, French, and Provençal from a single source, thus anticipating the classification Neo-Latin or Romance later applied to them. He divides Italian dialects into 14 groups and tries to ascertain which is best suited to a tragic or lofty style, reaching the conclusion that none will suffice and that a new language must be formed by putting together the best elements that they have in common. In the second book he takes up the use of noble language in the loftiest form of poetry, which is to him the *canzone* or lyric, and studies the structure of this form.

The 13 Latin *Epistolae*, which are of considerable autobiographical interest, are close to the *De vulgari eloquentia*; they are practical demonstrations of the importance which Dante attached to painstaking study as the way to attain art. The *Epistolae* reflect many of the convictions we find in *De Monarchia*, a Latin work of a later date than *Il Convivio*, whose political views it amplifies and emends. In the three books of *De Monarchia*, Dante maintains that the world should be governed by one emperor, that this world empire is a prerogative of the Romans, and that emperor and pope are independent of one another, deriving their authority direct from God.

Among Dante's minor works we may note some of the *Rime pietrose* and the splendid political poem beginning: "*Tre donne intorno al cor mi son venute*."

Petrarch.—Politics did not play a major role in the life of Francesco Petrarca (1304-1374), known in English as Petrarch, whose chief themes are his love for Laura, his studies, and his soul. Petrarch's great love inspired *Il Canzoniere*, an idealized account of his sentiments from the first time he saw Laura until some time after her death. The prevailing feeling in *Il Canzoniere* is one of meditative sadness against a religious background that emerges more and more distinctly until the work ends with a hymn to the Virgin Mary. The originality of this book lies in the gentle contrast between love and religion, set forth in an intimate story whose bare facts count for less than their reflection in the thoughtful mind of the poet. *Il Canzoniere* set the style for lyric poetry for centuries thereafter and had a lasting influence on the love lyrics of every country of Europe. (See PETRARCH'S SONNETS.)

Petrarch also holds a prominent place in the history of the Renaissance, and may be called the first of the humanists. The Latin of the poem *Africa*, the *Epistolae metricae*, the prose letters, the moral and religious works, and *Secretum*, a book of confessions, is much closer to the classical model than that of Dante. Because of his mastery of Latin style, his deep study of the classics, and his search for lost ancient manuscripts, we may say that with Petrarch the history of humanism begins.

Boccaccio and the Lesser 14th Century Writers.—Giovanni Boccaccio (1313-1375) is less important than Petrarch in the history of humanism and linguistic development, but equally so with regard to the imprint he left on subsequent literature. His masterpiece, the *Decameron*

(q.v.), was the only model followed by Italian short story writers up until the 18th century and has exercised a continuous influence on Italian prose. This work is made up of 100 tales told by seven young ladies and three young gentlemen who take refuge in the country near Florence during the plague of 1348. The subject matter comprises tragedy, burlesque, adventure, and love; the style is now slow and solemn, now rapid and vivacious. The whole makes up a many-sided picture of the life of the gentry, clergy, scholars, rascals, and common people of the time and has a greater variety of realistic characters than any Italian prose work before the 19th century *I promessi sposi*. There is promise of the masterpiece that was to follow in Boccaccio's youthful prose and poetry, particularly in *Il ninfale fiorentino*, an idyll rich in tender and dramatic scenes.

Franco Sacchetti (1335?-1400) is a talented writer of anecdotal short stories pitched in a minor key and concerned with middle-class and peasant life. Dino Compagni (1265?-1323) writes in a fast-moving and dramatic style of the Florence of the time of Dante. Religious writers of diverse temperaments include the anonymous author of the *Fioretti di San Francesco*, the simplest and most graphic biography of St. Francis of Assisi; Domenico Cavalca (c. 1270-1342), who adapted from the Latin the psychologically penetrating *Vite dei Santi Padri*; Jacopo Passavanti (c. 1300-1357), whose *Specchio di vera penitenza* contains some of the most effectively dramatic pages of medieval literature; and St. Catherine of Siena (1347-1380), whose letters are the most passionate expression of mysticism in Italian literature.

Humanism and the 15th Century.—The period from the age of Dante to the middle of the 16th century was one of deep transformation in Italian life and letters. The change came about slowly until halfway through the 15th century, when it consciously quickened its pace. By the second half of the century educational, literary, artistic, civic, and moral ideals were far removed from those of the 13th century and in some cases diametrically opposed to them. The ancients came to be considered masters of literature and the plastic arts and of the art of living as well. The rediscovery of Greek and Roman manuscripts and archaeological remains influenced art and letters, while at the same time the destiny of man and philosophical problems in general were seen in a new light and explained in a new manner. This period of change is called the Renaissance, and the philological inquiry which brought about the renewal of classical culture is known as humanism (q.v.), from *studia humanitatis* (studies aimed at perfecting the development of the human spirit by acquaintance with the grandeurs of the past).

Forerunners of humanism besides Petrarch were Albertino Mussato (1261-1329) and Lino Coluccio di Piero Salutati (1331-1406); its center was Florence; and the first great humanists to find and annotate ancient manuscripts were Giovanni Francesco Poggio Bracciolini (1380-1459) and Lorenzo Valla (1406-1457). Other centers were the academy at Rome headed by Giulio Pomponio Leto (1428-1498), and the Accademia Pontaniana at Naples, named after its most illustrious member, Giovanni Pontano (1426-1503). At this time the first great libraries were formed and culture was encouraged by the wealthy noblemen of Naples, Ferrara, Milan, and

other cities as well as by the popes. Many authors wrote in Latin; Pontano, the greatest among them, while he imitated classical verse, also sounded a note of contemporary reality.

Colloquial Italian, submerged for a while in the humanist illusion that Latin could once more become a living language, was used in such works of a popular character as the *sacre rappresentazioni* (miracle plays) and love lyrics of Leonardo Giustiniani and the writings of other authors of various degrees of learning. Among them were Lorenzo de' Medici (1449-1492), who was prominent in the cultural life of Florence and wrote poems and songs for carnival celebrations, among them *Trionfo di Bacco e Arianna*, which is among the best lyrics of the century; Politian (Angelo Poliziano, real name Angelo Ambrogini, 1454-1494), author of *Orfeo* and *Stanze per la Giostra di Giuliano de' Medici*, an unfinished poem of incomparable polish and charm; and Luigi Pulci (1432-1484), whose poem *Il Morgante Maggiore* recalls in a style alternately tripping and stately the events of the Carolingian cycle and creates the new and immortal figure of the glutton Margutte. Away from Florence, in Ferrara, we have Matteo Maria Boiardo (1434-1494), author of *Orlando innamorato* (q.v.), wrought from material half Breton and half Carolingian in a preponderantly chivalrous, fairy-tale manner. The most notable prose writers are the architect Leon Battista Alberti (1404-1472), author of the treatise *Della Famiglia*, in dialogue form, of which certain pages are the best extant documentation of the humanistic ideals of wisdom and balance; Leonardo da Vinci (1452-1519), whose observations on life and nature show the religious element in the humanistic attitude toward the world; and Jacopo Sannazzaro (1458-1530), author of *Arcadia* (q.v.), a pastoral and amorous romance which enjoyed extraordinary success all over Europe for several centuries.

First Half of the 16th Century; Ariosto and Machiavelli.—The exaggerated rhetoric and sensuality of much of 16th century literature have detracted from its reputation. There flourished during this period a literature serious in form and content and another that was frivolous in both. That is, there was a formal literary school and also a literary production that remained light and casual even when it was camouflaged by rhetorical devices derived from Latin writers and from Boccaccio. The literature of the first half of the century was based on Platonism (q.v.) and on classical wisdom and moderation. The moral aspirations and strength of the period turned toward the world and were bounded by a concern for man's position within its confines. In this sense, the 16th century grew out of the century that preceded it and is fittingly represented by Machiavelli and Ariosto.

Lodovico Ariosto (1474-1533) was for many years in the service of the Este family in Ferrara and the Garfagnana region. His *Satire* depict the worries and restrictions imposed upon him by his court duties in contrast to the poetical genius that drew him toward a quiet life where his imagination might find free rein. His poem *Orlando Furioso* (q.v.) portrays in a series of varied and skillfully arranged episodes his own half-dreaming, half-practical nature. His imagination is agile but never extravagant; it is restrained and colored by an intense feeling for reality which never fails to surprise us in this teller of extravagant tales. The plot, drawn from

the Carolingian cycle, tells of the struggle between Christians and Saracens around Paris, where the scene of the poem is laid. But the real subject is Orlando's ill-fated love for Angelica, which eventually drives him mad. This madness dominates the greater part of the poem, but around it are built up any number of other love stories, intermittently connected with one another in an abrupt rhythm which is the poem's magical charm. The focus of the action is the palace of Atlante, where the knights wander about in a vain and illusory search for the image of their loved ones; another central episode is Astolfo's ascension to the moon. In this poem everything is at the same time concrete and elusive; the reader seems to be looking at a scene from real life when it melts away as if in a dream. Every sentiment appears and disappears again in an endless whirl of adventures; only Orlando's love for Angelica endures, in increasing tempestuousness. The style is the most natural and flowing ever to be achieved by a poet, and it has been imitated over and over again. We can see its influence in Francesco Berni and numerous poets of chivalry of the time, and it crops up continually in the mock-heroic verse of the 18th century, either alone or mingled with the heritage of Torquato Tasso and Giambattista Marino.

Niccolò Machiavelli (1469-1527), living in a period when Italian independence was disappearing, was the first prophet of its resurrection and the chief of its political thinkers. His two masterpieces are *Il Principe* (*The Prince*, q.v.), a political treatise, and a comedy entitled *La Mandragola* (*The Mandrake*).

Il Principe is based on a new and realistic political morality. The kingdom of this world is to the strong, and fortune smiles upon him. Amid a floating and spineless multitude we find a few men endowed with intelligence and will power. The heart has no place in Machiavelli's political system, and kindness is tolerated only when it does not sap a leader's energy and block the accomplishment of his plans. Machiavelli esteems strength of mind and purpose harnessed to a single goal, the highest good of the state. This treatise is a handbook for political leaders; it was written in order to instruct a prince how to take advantage of the fatal weakness of the multitude and turn it into the basis for a powerful and well-organized government. Machiavelli's philosophy is aristocratic as well as pessimistic to the point of cynicism; he has no love for the common people. It is significant that the characters of *La Mandragola*, which ranks with Carlo Goldoni's *I rusteghi* as a masterpiece of the Italian theater, should be people of humble estate whom the author treats with the utmost scorn. His attitude toward these characters is identical with the one that he recommends for a prince toward his subjects.

Machiavelli's political philosophy is inconceivable divorced from the idea of the people as passive and sheeplike masses; this is the core of his realism. No one has ever analyzed as thoroughly as Machiavelli did the temper of the leader and that of the crowd. Before his analysis political theorists had studied how man should behave rather than his actual behavior; they pursued Utopian ideals while he adheres to the "real truth." We must look for the cause of Machiavelli's attitude in the inert fatalism in which most Italians of his day had taken refuge when their country was in danger. His reaction was to call

for a prince or strong man able to stand up against fate.

The *Discorsi sulla prima deca di Tito Livio* and the series of dialogues called *Dell'arte della guerra* complete Machiavelli's political works. In these writings, Machiavelli reveals himself as a pupil of the ancient philosophers, not in regard to his style, whose terse, muscular, and trenchant quality is far from the prevailing classical model, but in his theories of life and government. The theme of *La Mandragola* is as indelicate and comic as that of a tale by Boccaccio and arouses a feeling of amusement tempered by severity. The atmosphere is cynical and sardonic from beginning to end, while the positive thought and lucid style remind us continually of *Il Principe*. In the *Storie fiorentine* we again meet the Machiavellian conception of history as the creation not of the people but of strong personalities.

Colder and more exact are the historical works of Francesco Guicciardini (1483-1540). His *Ricordi civili e politici* stems not from a desire to formulate general rules of human conduct, but from an attempt to describe the myriad variations of human behavior. His historical method is analytical, especially in the *Storia d'Italia*, where he demonstrates an unusual ability to weigh and coordinate the circumstances surrounding a given action and leaves with the reader an impression of wide-ranging vision.

Machiavelli and Guicciardini are both realists. Other writers have left us a more idealistic picture of the 16th century, among them Baldassare Castiglione (1478-1529), whose *Il Cortegiano* is an ample and artistic picture of court life; and Pietro Bembo (1470-1547), whose *Gli Asolani* is an exaltation of Platonic love. These moralists, too, show in their style and their balanced outlook on life the strong influence of the classics. Noteworthy for the same reason are *La prima veste dei discorsi degli animali* by Agnolo Firenzuola (1493?-1545), many pages of Antonio Francesco Doni (1513?-1574), and *La Circe* by Giovanni Battista Gelli (1498-1563).

There is an abundance of Latin writing in the 16th century, but even more remarkable is *Baldus*, a poem by Teofilo Folengo (1496?-1544) written in macaronic or dog Latin, a parody of the classical tongue. (See MACARONIC VERSE.) This poem takes up the cudgels against the courtly and literary life; it embraces nature as opposed to refinement and represents a diametrically opposite view to that of *Il Cortegiano*. Without any intention of parody, Angelo Beolco (1502-1542), known as Il Ruzzante, makes use of the same realistic background in his brief dialect comedies of peasant life. Defiant of convention and often immoral are the copious writings of Pietro Aretino (1492-1556), who is a typical representative of the widespread degeneracy of the age, mirrored less in his comedies than in the huge bacchanalian work called *Ragionamenti*. Benvenuto Cellini (1500-1571) had the same impetuous temperament and left us in his *Vita or Autobiography* the liveliest and most complete picture of the boldness and vanity of a 16th century artist. (See CELLINI'S AUTOBIOGRAPHY.) The comic verses of Francesco Berni (1497-1536) have less intrinsic value, but his style influenced this form of writing for two centuries and we must grant him both cleverness and facility of expression.

Around these important authors is a galaxy of minor figures, chiefly writers of short stories and comedies. Such short story writers as Matteo

Bandello (1480?-1562) and Il Lasca (Antonio Francesco Grazzini, 1503-1584) are followers of Boccaccio; the comedians copy classical Latin models with the addition of contemporary material. *La Veneziana*, of unknown authorship, is by far the best comedy of the 16th century and, with *La Mandragola*, the only one which does not conform to a conventional pattern. Lyric poetry, except for Gaspara Stampa (1524?-1554), Caleazzo di Tarsia (1520-1553), and Michelangelo, is still limited to the forms laid down by Petrarch.

The Age of Tasso.—Toward the middle of the 16th century conscience and taste underwent a revolution. The Counter Reformation called men back to forgotten duties, although men proceeded to perform them mechanically and without enthusiasm. Michelangelo Buonarroti (1475-1564) interpreted in painting the spiritual needs of the time, but no writer gave himself up wholeheartedly to the stern injunctions of the church in its attempt to recover the mastery of men's souls. The only important writers of this period, besides Tasso, were the physicist Giambattista della Porta (1538?-1615), who introduced elements of fancy and imagination into comedy; Giordano Bruno (1548?-1600), who in his philosophical works, particularly *Spaccio della bestia trionfante*, succeeded by means of a grandiose and baroque style in tracing a vast, powerful, and noble conception of the world; and Giovanni Battista Guarini (1538-1612), whose pastoral drama *Il pastor fido* did more than Tasso himself to transform poetry into a musical attenuation of reality.

Torquato Tasso was born at Sorrento in 1544 and lived for some time at the court of the Este family in Ferrara. He was driven to a wandering existence by a restlessness which for several years took the form of insanity, and died at the convent of Sant'Onofrio in Rome in 1595. His *Gerusalemme Liberata* (*Jerusalem Delivered*, q.v.) marks the beginning of a new period of Italian literature, which was to be strongly influenced until after the romantic period by his style and way of thinking and feeling.

Gerusalemme Liberata is a serious and melancholy poem in 20 cantos which portrays in the guise of history Tasso's own frame of mind. It relates, rather than the conquest of the Holy City, the passions of the two Christian heroes, Rinaldo and Tancredi (Tancred). The love story of Rinaldo and Armida occupies most of the poem from Canto IV to Canto XX, while the romantic adventures of Tancredi, which are first mentioned in Canto III, end only in Canto XIX. These two stories form the framework and plot of the poem. Beside the two heroes we have the feminine figures of Armida, Erminia, and Clorinda, who give rise to some of the most famous passages, including Erminia's flight among the shepherds, and Clorinda's death, brought about by a fatal error, at the hands of her lover. A dramatic fatality pervades the whole poem, and even the two pagan protagonists, Argante and Solimano (Suleiman), who do not enter into the sentimental episodes, are seen in a fundamentally melancholy light. There is in *Gerusalemme Liberata* a new feeling for life and nature, quite different from that of *Orlando Furioso* and its time, and expressed in a plaintive style in which words are valued less for their meaning than for their musical quality. The poem was immensely popular. It set the rhythm and style of the poetry of the century to follow, and for over 200 years was a source of romantic

subtleties heretofore unknown in Italian literature.

Tasso's earlier pastoral drama, *Aminta*, a finely balanced compromise between the traditional treatment of a conventional subject and the expression of a dreamy and meditative personality, met with less success. Here his poetic talent was muzzled by the requirements of dialogue, for which he had not yet found the form midway between the dramatic and the lyrical that he used in *Gerusalemme Liberata* for the expression in apparently objective terms of his innermost feelings.

The 17th Century.—In the 17th century poetry, uprooted from reality, became superficial and overrefined and ceased to interpret the life and spirit of the age. It was a mere tour de force, built on rhetorical figures of speech, particularly on complicated metaphors, and on alliteration and other devices related to the music of the period. Lyric poetry adopted new themes, but its departure from tradition was motivated merely by a frivolous desire for the strange and new. Sensuality was pronounced, and there was a taste for description, preferably of luxuriant scenic backgrounds. Religious themes were often marred by the poet's sensuality, yet there was in the 17th century a vein of sincere melancholy arising not only from the stern teachings of the Counter Reformation, but also from the contrasting pomp and theatricality of society and the fine arts. The writer most representative of this religious spirit was Federigo della Valle (1565–1628), whose tragedy *Judit* was the only great work of its kind before Vittorio Alfieri. Tommaso Campanella (1568–1639) was another poet of high moral standards, though more of a philosopher by vocation.

Perhaps the most typical 17th century writer was Giambattista Marini or Marino (1569–1625), who produced a number of poetical works, conspicuous among them *L'Adone*, made up of a plethora of incidents told in the exaggerated and disorderly manner characteristic of the time. Fulvio Testi (1593–1646), more oratorical than poetic, had ideas opposed to those of Marini, and so did Gabriello Chiabrera (1552–1637), a forerunner of the insipid airs and graces of the Arcadian school. A prose writer of the same verbosity as Marini but free of his metaphorical extravagance was Daniello Bartoli (1608–1685), author of *Storia della Compagnia di Gesù*, a long history of the Jesuit order. Giovanni Battista Basile, count of Morone (1575–1632), who wrote entertaining fables in Neapolitan dialect, obtained unusual artistic effects from the flowery imagery proper to the 17th century. Two poems unconnected with contemporary literary trends were the burlesque *La secchia rapita* of Alessandro Tassoni (1565–1635), containing characters and episodes of enduring liveliness; and the dithyrambic *Bacco in Toscana* of Francesco Redi (1626?–1697 or 1698), a lively story of the inebriation of Bacchus.

The more serious side of 17th century literature is represented by the profound and sometimes keen-witted scientific prose of Galileo Galilei (1564–1642), the great opponent of Aristotelian philosophy and the Ptolemaic system, author of *Dialogo dei due massimi sistemi del mondo* and *Il saggiaiore*, and founder of a literary trend as well as a scientific school. Other serious writers were Paolo Sarpi (1552–1623), author of *Storia del Concilio di Trento*; and Traiano Boccalini (1556–1613), whose *Ragguagli di Parnaso*

and *Pietra del paragone politico* were the best political essays of the time.

The 18th Century.—In 1690, there was founded in Rome the Arcadia, an academy whose purpose was to combat the bad taste of the 17th century. This academy held sway for the greater part of the 18th century, steering into oversimplification and impoverishment the idyllic and Anacreontic trend of the school it sought to supplant and accentuating its saccharine quality. The chief exponents of this academic effort were Paolo Rolli (1687–1765) and Carlo Innocenzo Frugoni (1692–1768); its only real poet was Metastasio (originally Pietro Trapassi, 1698–1782), who wrote two restrained and graceful songs and several dramas, including *Didone abbandonata*, *Olimpiade*, and *Demofonte*, in which he endowed poetry with a new and melodramatic tone. Metastasio is the only poet in whom melodrama is not a fault but an original and genuine lyrical expression in which feeling is transformed into song, and melancholy, sorrow, regret, jealousy, and doubt no sooner appear than they vanish in melodious echoes.

There are traces of Metastasio's influence in Carlo Goldoni (1707–1793), the greatest Italian writer of comedy. His comedies are in appearance realistic depictions of the Venetian life of the age, but their realism is filtered through an optimistic and typically 18th century temperament and falls into cadences not far removed from those of Metastasio's melodrama. Goldoni continued Metastasio's gracefulness, enriching it and turning it away from the ancient heroic world toward the middle-class atmosphere of modern times. His plays impress us not as direct reflections of life, but as theatrical fictions based on lifelike models. The best of his comedies, which are written partly in Italian and partly in Venetian dialect, are *I rusteghi*, *La locandiera*, *Il ventaglio*, *Le baruffe chiozzotte*, and *La casa nuova*. Before Goldoni the Italian comic theater was the province of the *commedia dell'arte*, entrusted to the brilliant improvisation of great actors. (See **DRAMA—The Renaissance**.) The *commedia dell'arte* was famous throughout Europe and popularized such figures as Arlecchino (Harlequin), Pantalone (Pantaloon), and Brighella, but with the passage of time it degenerated into buffoonery. Goldoni opposed this tendency with his carefully thought-out comedies drawn from direct observation.

In the second half of the century the academic versification of Arcadia gave way to poetry of a more serious kind. Even Giovanni Meli (1740–1815), the great poet of Sicilian dialect, whose choice of subject matter and background recalls the Arcadian school, followed new and healthier ideals, as if he had been touched by the spirit of Jean Jacques Rousseau. The literature of this period stemmed from a general renewal of culture, as in the work of Giovanni Battista Vico (1668–1744) and Lodovico Antonio Muratori (1672–1750), who marked the revival of the traditional study of philosophy and history and paved the way, each in his own field, for the exact philological and critical scholarship of the 19th and 20th centuries. The decade of greatest interest falls later, from 1755 to 1765, the years dominated and epitomized by Giuseppe Parini.

Between Metastasio and Alfieri a large number of writers, both followers of the Arcadian school and independents—literary critics, moralists, and disseminators of ideas—contributed to a

renewal of literature. Among them we may name Francesco Algarotti (1712-1764), Saverio Bettinelli (1718-1808), Gaspare Gozzi (1713-1786), and, most talented of all, Giuseppe Marc'Antonio Baretti (1719-1789), whose review *La frusta letteraria* opposed the lazy superficiality of Arcadia, and Ferdinando Galiani (1728-1787), the most biting critic of the abstract, antihistorical, and encyclopedic mentality of his time. New ideas were spread by such periodicals as *La frusta letteraria*, Gozzi's *Osservatore veneziano*, and *Il Caffè*, published in Milan and written largely by Pietro Verri (1728-1797) and Cesare Bonesana, marchese di Beccaria (1735?-1794), author of *Dei delitti e delle pene* (1764), which won fame throughout Europe in the field of penology.

Beccaria's influence extended to Giuseppe Parini (1729-1799), who wrote odes of public and personal interest (*Il bisogno*, *A Silvia*, *La caduta*, *Alla Musa*, *Il messaggio*) in a taut and finished style and on a more solid basis than the contemporary neoclassic poets, and a longer free verse poem, *Il giorno* (*The Day*). In this poem the writer pretends to be the mentor of a young man of fashion, and, while instructing him as to how he should pass the day, he satirizes his idle and vicious existence. The picture of society, narrow in the first section, *Il mattino*, is gradually enlarged in the *Mezzogiorno*, *Vespro*, and *Notte* until it comprises a wide variety of aristocratic types and foibles.

The decline of the Arcadian school was hastened by new romantic trends, particularly the melancholy vein of Thomas Gray, Edward Young, and the poems of Ossian (q.v.). The latter were introduced to Italy by the verse translation of Melchiorre Cesarotti (1730-1808).

This, then, was the background of Vittorio Alfieri (1749-1803), whose ideas and temperament, however, make him less a product of his century than a rebel against it, a forerunner of romanticism and the Risorgimento (q.v.) rather than an interpreter of the currents around him. Although Alfieri was brought up in Piedmont, a region where French culture prevailed, he became an enemy of the French; he despised the word philosophy, which was venerated by his contemporaries; he opposed the Enlightenment, and lived in a heroic world of his imagination. His principal works are his *Vita*, an autobiography, and his tragedies. Everything that Alfieri wrote is stripped down to essentials, which means that it is concerned with himself as protagonist, with his stubborn, reserved, and melancholy childhood, his youthful dissipation accompanied by an unconscious and desperate longing for a brilliant future, and the manhood out of which he created some masterpieces of despair: *Saul* (q.v.), *Mirra*, and *Filippo II*. The theme of Alfieri's tragedies is an iron will which is fed by an all-absorbing passion or struggles to escape from its bonds. Their noble tone derives from this element of will, which projects the emotions of a world vaster than our own. Several of the tragedies deal with the passion for freedom and influenced the period of the Risorgimento, but they are his best works from a literary point of view.

Foscolo, Leopardi, and Manzoni.—The pre-romantic themes which influenced Alfieri were enriched in the following years. On the other hand, the vogue of the classics, brought about by the studies of the great German archaeologist Johann Joachim Winckelmann, the ambitions of

Napoleon, and the reaction against Arcadian superficiality, caused a recrudescence of classical forms. Vincenzo Monti (1754-1826), who lived during the zenith of the Arcadia, the influx of nocturnal and graveyard poetry inspired by Ossian, and the revival of classical style and taste (which was nevertheless open to new influences), is the poet most representative of his time. His translation of the *Iliad* is still known today.

The themes which are occasional and uncertain in Monti's poetry become strong and persistent in Ugo Foscolo (1778-1827). Love of country, which was superficial in Monti, is one of the prevailing themes of *Ultime lettere di Jacopo Ortis* (*Last Letters of Jacob Ortis*, q.v.) and *I Sepolcri*; the memory of past grandeur becomes a sacred tradition and the object of a cult; and classicism, which in Monti was mere ornamentation, means to Foscolo a purification of his romantic soul and a sublimation of his own melancholy and unrest in the sphere of an ideal world. Romanticism, which was only an external stimulus to Monti's poetry, takes on in Foscolo a note of profound pathos. Foscolo, the heir to Alfieri's patriotism and romantic feeling, the master of the Risorgimento and of the later poet Giosuè Carducci, and the forerunner of Giacomo Leopardi's pessimistic negation, is akin in his imaginative and melancholy spirit to the romantic poets north of the Alps, and his work forms an integral part of contemporary European literature. This work ranges from *Ultime lettere di Jacopo Ortis*, an early and unorganized but rich explosion of his romantic temperament, to *I Sepolcri*, in which romanticism and the discipline of classical training are perfectly balanced, and to the fragmentary *Grazie*, where classicism takes the upper hand, inspiring passages of exquisite poetry which lack, however, the passion that was the most fertile source of his inspiration. Closer in spirit to the *Grazie* are his two odes, and particularly delicate is the one *All'amica risanata*. Akin rather to *I Sepolcri* are his sonnets, among which *Alla sera* and *In morte del fratello Giovanni* give us a finished poetic portrayal of the writer.

While Monti is the decorative historian of the Napoleonic period and Foscolo its prophetic antagonist, a third poet, who wrote in Milanese dialect, Carlo Porta (1775-1821), is not the mere chronicler that he may appear at first glance, but a vivid painter of the age. He depicts life among the common people, nobility, and clergy and unobtrusively tells in verse of the repercussions of history upon the existence of the ordinary citizen. In the minor writers grouped around these great figures we see the continuation in both poetry and prose of the neoclassic tradition.

Though he belongs to the classical school, Giacomo Leopardi (1798-1837) stands in a category all his own. By virtue of his self-control, the chiseled lines of his poems, and the severity of his form, he is the most classical of Italian lyric poets; the atmosphere of his poems is as limpid and uncluttered as that of *I Sepolcri* is wavering and shadowy. But Leopardi is also influenced by the romantic tradition, whose despair, the *mal du siècle*, was anticipated in Foscolo's *Ultime lettere di Jacopo Ortis*. Leopardi does not belong to the age of Napoleon, but to the following period of depression and pessimism which set in as a reaction to its tumultuousness and was fertile soil for the growth of romanticism. He takes over many of Foscolo's most melancholy themes and early in his career

shuts himself up in a state of grief which reflects not only the unhappiness of his own life but the mood prevalent in contemporary European literature. But Leopardi's despair is not morbid; it assumes well-defined contours and rises to a wider sphere where worldly troubles disappear and melancholy is the product not of human vicissitudes but of a deep feeling for man's inevitable fate. This is the meaning of such lyrics as *L'infinito*, *Canto notturno d'un pastore errante dell'Asia*, *Il sabato del villaggio*, and *La sera del dì di festa*, and the more subjective *A Silvia*, *Le ricordanze*, and *Alla sua donna*. It is, indeed, the significance of all his best poetry, which has as its point of departure the familiar scenes of his native town of Recanati but reaches out into the world. (See also ODES.) The prose *Operette morali* (*Dialogues of Leopardi*, q.v.) are thoughtful rather than sentimental. Their form is either narrative or dialogue, interspersed with imaginative passages which lend a gloomy majesty to the writer's conclusions. They are clear evidence of Leopardi's pessimism and serve as an introduction to his *Storia del genere umano*, a description of man's fatal satiety with the goods of this earth and his consequent state of ennui.

Alessandro Manzoni (1785-1873) is half classical, half romantic, although he is generally known as the leader of the Italian romantic school. An important factor not only in his private life but in his writing was the religious conversion he underwent in 1810. He had received his early philosophical education during the revolutionary period, that is, under the influence of clear, logical, and ironical French culture. His conversion took place at a time when mortal weariness and a wave of intellectual disillusionment were paving the way for the political, philosophical, and literary ideas of the period after Napoleon. The first fruits of his conversion were the *Inni sacri*, greatest among them *La Pentecoste*, and the *Osservazioni sulla morale cattolica*. There is religious feeling in his tragedies, *Il conte di Carmagnola* and the better written *Adelchi*, memorable for the choruses *Dagli atri muscoli* and *Morte d'Ermengarda*.

Manzoni's acknowledged masterpiece, *I promessi sposi* (*The Betrothed*, q.v.), which first appeared in 1825-1827, but is better read in the revised 1840-1842 edition, is based on a Christian concept of life. This novel is the love story of two young peasants whose marriage is opposed by an overbearing petty nobleman, abetted by the brutality and public disasters of the time. The action takes place around the Lago di Lecco and in Milan from 1628 to 1630. These scenes were dear to Manzoni and he displays his affection in mellow descriptions and a wealth of detail concerning everyday life. The period of the novel is made vivid to the reader not only by painstaking though not too obvious research, but also by the writer's extraordinary ability to infuse a rich, lifelike quality of thought and feeling into past events and to master and transfigure them with his own austere moral and religious ideas. Manzoni reconstructs and interprets this period with greater penetration than any of the others he studied. It lends itself to the display of the spiritual and artistic richness of his temperament and offers him numerous and skillfully woven themes illustrative of his irony and melancholy and a view of life which appears optimistic and pessimistic in turn and escapes categorical definition as either, because it has passed beyond senti-

mentality and prejudice and faces the complexities of real life.

Romanticism; De Sanctis.—Romanticism had only a limited influence on Italian literature: it never brought about the complete transformation that took place in other European countries. Italian romanticism restricted itself to a choice of certain themes and to a statement of theories of literature and nationality. In this respect, the most typical writer was Giovanni Berchet (1783-1851), a contributor to *Il Conciliatore*, author of the romantic manifesto *Lettera semiseria di Grisostomo*, and of the poetical works *Romanze* and *Fantasie*. A half patriotic and half satirical poet was Giuseppe Giusti (1809-1850), whose chief concern was with his native Tuscany, as that of the Roman dialect poet, Giuseppe Gioacchino Belli (1791-1863), was with Rome. Historical novels, notably those of Tommaso Grossi (1791-1853) and Massimo Taparelli, marchese d'Azeglio (1798-1866), flourished; they were modeled after Manzoni and had a patriotic and romantic tone. This same tone prevailed in autobiographies and autobiographical novels by such writers as Silvio Pellico (1788-1854), Luigi Settembrini (1813-1877), Giovanni Ruffini (1807-1881), and Ippolito Nievo (1831-1861). Nievo died very young, leaving an enormously promising book, *Confessioni di un ottuagenario*. The writers of the following generation—Giuseppe Mazzini (1805-1872), Francesco Domenico Guerrazzi (1804-1873), and Aleardo Aleardi (1812-1878), were deeply romantic. For some passages of excellent poetry we should mention Giovanni Prati (1815-1884). More complex are the later Lombard poets of an ultraromantic group known as the *scapigliati*, Emilio Praga (1839-1874) and Arrigo Boito (1842-1918). Giacomo Zanella (1820-1888), the meditative poet of *Sopra una conchiglia fossile nel mio studio*, and the series of sonnets, *L'Astichello*, and the poet-novelist Niccolò Tommaseo (1802-1874) hold a place of their own.

The greatest work of the Italian romantic period is that of Francesco De Sanctis (1817-1883), one of the major literary critics of any time and country. Living himself through the crucial period of the Risorgimento, he wrote the first real history of Italian literature.

From Carducci to the Present.—The dominant literary trend of the second half of the 19th century was a reaction to romanticism and a return to a healthier view of life. The lyric tone gave way to the study of contemporary backgrounds and the structure of modern society, and writers dealt with the people around them rather than with their own egos. The theater, in a first, moderate return to the portrayal of actual life, was dominated by Paolo Ferrari (1822-1889), Vittorio Bersezio (1830-1900), and Pietro Cossa (1830-1881). Later, with Giuseppe Giacosa (1847-1906), Giacinto Gallina (1852-1897), Gerolamo Rovetta (1851-1910), and Marco Praga (1863-1929), realism was accentuated into verism, though never exaggerated. In fiction, these tendencies appeared, at least in more important works, only in the verist period, with Luigi Capuana (1839-1915), Emilio De Marchi (1851-1901), and Matilde Serao (1856-1927).

Lyric poetry took an antiromantic and anti-classical turn about 1860, beginning with Vittorio Betteloni (1840-1910) and going on to Lorenzo Stecchetti (pseudonym of Olindo Guerrini, 1845-1916). Later it was absorbed by the *crepuscolare* (twilight) school and the futurists. Giosuè Car-

ducci (1835–1907), a poet of aristocratic temperament remote from everyday life, was the most deliberate opponent of the false and unhealthy side of the romantic movement. His best work is in the two volumes *Rime nuove* and *Odi barbare*. Carducci took his material from history and his own surroundings and wove it into an expression of his balanced and straightforward personality. History, the classics, and his natural youthful exuberance combined to breathe a new spirit into the Italian lyric. He was inspired by the powerful spectacle of the glories of ancient Rome and the medieval Italian communes, by the strength and self-control of the classic writers, and by a vigorous and sympathetic outlook on the life around him. Carducci is the most concrete and nobly realistic of modern Italian poets. The fragrance of the woods and fields and the boundless silence of a southern landscape are all between the covers of his books. After Carducci studies of nature were complicated either by spiritual problems, as in Giovanni Pascoli, or by sensual violence as in Gabriele D'Annunzio.

Giovanni Verga (1840–1922) had a clear and manly view of life, but there was in him a strain of melancholy that Carducci never knew. His theme is the struggle of daily life, played against no majestic background and relieved by no unexpected adventures, but lived out in a mood of uninterrupted and taciturn sorrow. This is the subject of his best short stories—*Rosso Malpelo*, for instance—and his most successful novels, *I Malavoglia* and *Mastro don Gesualdo*. *I Malavoglia* is the story of a family that goes through endless trials with the weary and persistent hopefulness of the truly unfortunate. It is the first great example of the passage of the Italian novel from an epic to a lyric manner. *Mastro don Gesualdo*, less unified and more varied, tells of a man who rises by sheer tenacity from poverty to wealth, struggling against the envy, mistrust, and pride of both the aristocrats to whom he relates himself by marriage and the poor people with whom he grew up and whom he hopes to help. At the end of the book the hero is alone and forgotten. (See also CAVALLERIA RUSTICANA.)

Italian realism assumed a strictly regional character; it was Sicilian in Verga and Capuana, Tuscan in Renato Fucini (1843–1921), Neapolitan in Matilde Serao, and Sardinian in Grazia Deledda (1875–1936). Other regional works were the musical and melancholy poems in Neapolitan dialect of Salvatore di Giacomo (1862–1934) and the Roman poems of Cesare Pascarella (1858–1940).

Benedetto Croce (1866–1952) is an able critic of this period as well as a writer of clear and harmonious style. He is closer to Carducci and Verga than he is to the romantic soulfulness, mysticism, and decadent qualities of the writers making up the following Italian literary school: Antonio Fogazzaro, Arturo Graf, Giovanni Pascoli, and Gabriele D'Annunzio.

Antonio Fogazzaro (1842–1911) attempted to give spiritual guidance to those who were torn between science and religion, but he was not equal to this difficult task. He was sensitive, given to lofty feelings, and inclined to hear in nature the voice of a spirit mysteriously akin to that of man. This inclination is apparent to an overpowering degree in *Malombra*, an overly intricate and tempestuous novel which is an accurate reflection of Fogazzaro's own temperament. *Piccolo*

mondo antico (*The Little Old World*, q.v.), in which his contradictory impulses are better balanced, is more clear-cut. The scene of this novel is laid in places which Fogazzaro remembered from his childhood, and the plot is concerned with incidents of the time of the Risorgimento of which he had heard at first hand during the youthful years he spent in Turin.

Arturo Graf (1848–1913), like Fogazzaro, belongs to the movement of reaction against realism. His poetry begins with the bewilderment of a lost soul and eventually rises to a tragically religious note.

Giovanni Pascoli (1855–1912) was another opponent of realism, dominated by a sense of the mystery that surrounds and governs human life. From this sense of mystery comes a resignation to evil which amounts to passivity and may perhaps be attributed to the influence of Leo Tolstoy, just as his perplexity in the face of the problem of evil seems to derive from Fyodor Dostoyevsky. Such an ethical stand on the part of a contemplative nature like that of Pascoli necessarily led to the solitary, meditative, and bewildered attitude which he assumed toward life. His inner confusion pours itself out most naturally in the silent countryside where it is easiest to hear the mysterious voice of nature. His best collections of verse are *Myricae*, *Canti di Castelvecchio*, *Primi poemetti*, and *Poemi conviviali*. In Fogazzaro and Pascoli alike there is something effete, a weak moral fiber, a surrender to the feeling of mystery, a submission to the irrational, and hence an increase in the musical quality of their poetry to the detriment of line and construction—all qualities characteristic of decadence.

This trend culminated in Gabriele D'Annunzio (1863–1938), in whom were inextricably mingled the temperament of a Renaissance nobleman and that of a modern decadent, avid for subtle new sensations and intent on grafting obscure and magical meanings onto the appearances and events of life. D'Annunzio was prey to a fundamental dualism, torn between heroism and decadence, epic violence and heedless frivolity. The essence of his poetry, in the lyrics of *Alcione*, the tragedy *La Figlia di Jorio*, and the best pages of his novels—*Il Piacere* (q.v.), *Il trionfo della morte*, and *Il fuoco*—is gloomy, nervous, and ultraromantic. Although D'Annunzio's writing is quite frequently sensual in the extreme, we see him at his best carried away by music and suffering, lost in an ecstatic adoration of beauty, wondering at the discontent engendered by the enjoyment of beauty, and eager, all in vain, to penetrate its secret. (See also FRANCESCA DA RIMINI.)

Italian poetry has remained more or less derivative from Pascoli and D'Annunzio. This is true of Guido Gozzano (1883–1916), whose illness and consequent scepticism toward heroic ideals made him the most notable representative of the *crepuscolare* school, and it is equally true of futurism and pure poetry. Strictly Italian influences have been tempered by those of Georges Rodenbach, Walt Whitman, Émile Verhaeren, Stéphane Mallarmé, Arthur Rimbaud, Paul Valéry, and others. Among living poets, Eugenio Montale (1896–) is worthy of mention, and the most profound of all is Umberto Saba (1883–).

Among modern prose writers, Aldo Palazzeschi (1885–), author of *Stampe dell'Ottocento* and *Sorelle Materassi*, belongs in some ways to

the *crepuscolare* group but has a vein of mingled pathos and comedy all his own. *Rubè*, a novel by Giuseppe Antonio Borgese (1882–1952), is typical of the disillusionment following World War I. Emilio Cecchi (1884–) is an ultraromantic who has written some of the most brilliant pages of Italian prose. Antonio Baldini (1889–) and Riccardo Bacchelli (1891–) belong to no particular school; the latter has a talent for the sensory and concrete. Important anti-Fascist writers are Gaetano Salvemini (1873–1957), historian, and Carlo Levi (1902–), author of *Cristo si è fermato ad Eboli* (*Christ Stopped at Eboli*), one of the most interesting of the post-World War II writers. Among the younger writers of note are Vitaliano Brancati (1907–), and Elio Vittorini (1908–), whose novels have appeared in English translation.

Perhaps the two best-known 20th century writers after D'Annunzio are Alfredo Panzini (1863–1939), whose prose contains varied and skillfully handled themes, half scholarly and half frivolous, as in *La Lanterna di Diogene*; and Luigi Pirandello (1867–1936), author of many short stories, one remarkable novel (*Il fu Mattia Pascal*), and a number of plays whose desperate and harrowing themes, well suited to the modern temper, have secured their performance all over the world. (See also separate biographies of important authors; NOVEL, THE; and DRAMA.)

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6. THE ARTS. The first Christian art in Italy resembled closely the contemporary late Roman work. Like the pagan pictures, of the time, the paintings in the catacombs of Rome were done with a series of rapid strokes of the brush and very little shading against a light background. They were, however, distinguished by a new and largely symbolic iconography. Among the commonest of the symbols used were fish, ships, and vines. The sculpture of the period, consisting largely of bas-reliefs on sarcophagi, of which there are fine examples in the Lateran Museum, shows the same Roman Empire style.

EARLY CHRISTIAN AND BYZANTINE ART

After 313 A.D., when Constantine issued the Edict of Milan, granting legal status to the Catholic Church, architecture began to develop along new lines. This date marks the beginning of a new Christian art with forms of expression distinct from those of the ancient world.

Early Christian Churches.—In the fourth and fifth centuries, Rome was the chief artistic center of Italy. Among the great basilicas built in the city at this time were Old St. Peter's, which was later destroyed and rebuilt in the Renaissance; St. John Lateran, which we see today in baroque dress; Santa Maria Maggiore, the best preserved of all; St. Paul's Outside the Walls, which was rebuilt in the 19th century; and Santa Sabina, with its fine wooden doors. Circular buildings were also characteristic of the time: Mausoleum of Santa Costanza; Baptistery of the Lateran; Santo Stefano Rotondo. Mosaic decoration of interiors became common, and we have examples in Santa Pudenziana, Santa Maria Maggiore, Santi Cosma e Damiano, and Sant' Agnese.

The Byzantine Period.—The mosaics of Sant' Agnese in Rome date from the 7th century and show an increasing Byzantine influence. A new mystical spirit made for new forms of expression. Art abandoned the imitation of nature;

images lost their bodily mass, and colors were laid on a flat surface and were brightened in such a way that they gave an immaterial vision of light.

The chief monuments of the Byzantine period are at Ravenna, which was the capital of the Byzantine exarchate from the 6th to the 8th centuries (see section on *History*). Among them are the Mausoleum of Galla Placidia, the Baptistery of the Orthodox, Sant' Apollinare in Classe, Sant' Apollinare Nuovo, and San Vitale, all decorated inside with brilliant mosaics.

Sculpture veered away from prominent relief and effects of mass, and we see it flattened out on the sides of sarcophagi (many of which are found in Sant' Apollinare in Classe), or turned into the lacework of capitals and screens and the carving of pulpits and bishops' chairs. Other works of the Byzantine period survive in Naples and Milan.

THE ROMANESQUE PERIOD

The Romanesque period of Italian art lasted from the late 8th century to the early 13th century. The first part of this period, ending in approximately 1000 A.D., is known as early or pre-Romanesque.

Early Romanesque.—The monuments of this time are fewer in number than those of the Byzantine period, mixed in style, and imprecisely dated. Architecture and sculpture drew further away from the Byzantine tradition than did painting. The structures, scattered all over Italy, of the *maestri comacini*, who probably came from the Lago di Como region, derive many of their features from Byzantine architecture, but there is a changed relationship among them. They are heavier and thicker than the Byzantine churches, with brick walls that are interrupted by slit windows which admit little light. Churches of this type include San Pietro, Tuscania; San Salvatore, Brescia; the apse and presbytery of Sant' Ambrogio, Milan; and the baptisteries of Biella, Agliate, and Galliano. In Rome, on the other hand, the harmoniously proportioned basilicas of the 9th century—Santa Maria in Domnica and Santa Prassede, with its chapel of San Zenone, all decorated with mosaics, together with Santa Maria in Aracoeli—bear witness to the survival of a local architectural tradition of the early Christian period.

Since the churches are almost completely devoid of sculpture, we must look for the plastic arts of the time in carved capitals, baptismal fonts (Cathedral of Cividale, 8th century), ciboria (Sant' Apollinare, Ravenna), screens, and pulpits and above all in the work of goldsmiths, one of whose most notable examples is the altar by Vuolfvinio (Vuolfvinus) in Sant' Ambrogio, Milan, reminiscent of the Carolingian style.

In the Eastern Roman Empire, Byzantine art still prevailed, conserving its almost religiously set color values, its technical sumptuousness and refinement, and a progressive rigidity of both iconographic and stylistic themes. But in western Europe—France, the Rhineland, Ireland, Spain, and northern Italy—a new form of art was born, rising out of the Byzantine tradition, but branching away from it by virtue of greater feeling and inventiveness, the absorption of barbarian decorative motifs, and a renewal of plastic values. Italian art of these centuries represents one phase of this international picture. This process developed in richness and multiplicity during the Ro-

manesque period proper, which extended in Italy from about 1000 to 1200 and beyond.

Romanesque Art.—*Architecture.*—Romanesque architecture varies greatly from one part of Italy to another. Its style is most homogeneous in the Lombard sector, which covers Lombardy (Sant' Ambrogio, Milan; San Fedele, Como; San Michele, Pavia; and the Cathedral of Cremona); Piedmont (Monastery of San Michele, Val di Susa); Emilia (the cathedrals of Modena, an especially fine example; Parma, with its baptistery; Piacenza; Fidenza; Ferrara); and along the Adriatic coast. The architecture of this area is characterized by organic construction, vaulted ceilings, pilasters, arches, effects of mass and of light and shadow obtained by the use of bricks, deeply recessed portals, pillars standing in relief against the walls, blind arcades, porches, and rose windows. These characteristics are found with some local variations in churches of Marche (San Ciriaco Cathedral, Ancona); Umbria (San Rufino Cathedral, Assisi; San Pietro, Spoleto), where there are traces of influence from Latium; and Apulia (San Nicola, Bari; cathedrals of Trani, Troia, Bitonto, Barletta, and Altamura), where the Lombard style is mingled with Pisan, Norman, and Arab elements. In Rome and Latium, there prevailed the tradition of the Cosmati family, whose simple and serene churches remind us of early Roman forms, ornamented with a typical surface decoration of *tesserae* or plaques of colored marble in geometric patterns, as in the cloisters of St. John Lateran and St. Paul's Outside the Walls. In the Romanesque buildings of southern Italy, the mixture of Lombard, Norman, and Arab influences produced fanciful effects: cathedrals of Caserta Vecchia, Benevento (completely ruined in World War II), and Amalfi; and San Pantaleo, Ravello. Sicily was subject primarily to Arab influence, as is seen in the cathedrals of Cefalù and Monreale, with its magnificent cloister, and the Zisa of Palermo.

In western Venetia the Lombard influence was paramount (San Zeno and the Cathedral of Verona), but in the city of Venice the Byzantine tradition persisted in an elaborate and refined form: witness St. Mark's with its oriental cupolas, mosaics, and marble incrustations. In Tuscany the Florentine style was distinguished by a harmonious simplicity of structure and by the ornamentation of large surfaces with marble plaques in two colors and a geometric design: Baptistery of Florence; San Miniato al Monte, near Florence and the Abbey of Fiesole. In Pisa construction was more complex, and the most striking local characteristic is the superposition of external porches. The cathedral, begun in 1118, with its baptistery and bell tower, served as a model for many other churches outside the immediate region—San Martino, San Frediano, and San Michele, all in Lucca, where there was some infiltration from Lombardy—and for structures in Corsica, Sardinia, and even Apulia.

Sculpture.—Sculpture flowered along with architecture, and there was a rebirth of plastic feeling. It was sculpture that animated the façades, doors, and capitals of the churches, drawing inspiration from flowers and animals, but also emancipating itself from naturalism in order to create fantastic monsters and designs which blended with the architectural scheme. Plastic representations of the works and virtues of man, the months, planets, and signs of the zodiac—a

whole illustrated encyclopedia was unfolded before the eyes of the faithful. Sculpture is most abundant where architectural forms are most complex and massive, and less evident where flat surfaces and marble incrustations prevail, as they do in Florence, Rome, and Latium.

The first identifiable Romanesque sculptors are Viligelmo, who created the bas-relief stories from Genesis on the façade of the Cathedral of Modena (beginning of the 12th century); Niccolò, who decorated the façade of the Cathedral of Ferrara in 1135; and Benedetto Antelami (fl. 1177-1233), greatest of the three, who carved the *Deposition* in the Cathedral of Parma (1178) and the decorations of its baptistery (1196). The figures of prophets on the outside of the Cathedral of Fidenza are close to Antelami, if not by him. There are also many anonymous sculptures of high quality in the Cathedral of Modena; San Michele, Pavia; the Cathedral of Cremona; and San Zeno, Verona, with its 12th century bronze door.

In Tuscany much activity centered around the atelier of the Cathedral of Pisa. Maestro Guglielmo (William of Innsbruck), its chief artisan, did the old pulpit, which is now at Cagliari, in 1159. There is a notable stylistic resemblance between him and his Lombard and Provençal contemporaries, and he was the originator of a trend that held the field for over 100 years in Tuscany, with Gruamonte, Biduino, and Guido da Como.

In Pisa, after Maestro Guglielmo, Bonanno (Bonannus) held sway. His style was more decorative and nearer to the Byzantine model, as is seen in the bronze doors of the cathedrals of Pisa and Monreale (1186). There is an even stronger Byzantine influence in the reliefs on the main portal of the Baptistery of Pisa. In Lucca sculpture had a more Lombard Romanesque character, as in Guidetto's sculpture on the façades of San Martino (1204) and San Michele, and the scenes from the lives of St. Martin and St. Regulus under the portico of the cathedral. In Tuscany and Latium there was considerable sculpture in wood: Depositions (Tivoli, Pescia, and Volterra); crucifixes (Petrognano); and groups of the Virgin and Child. In the south sculpture flowered along with architecture, exhibiting a mixture of varied elements, particularly imagination: the portals at Troia and Trani; the bronze doors at Trani (by Barisano da Trani), and at Benevento (destroyed in World War II); the pulpits at Ravello, Salerno, and Sessa Aurunca; and everywhere carved capitals (notably beautiful in the cloisters of Cefalù and Monreale), friezes, doorposts, and bishops' chairs. Perhaps it was in the south, where Emperor Frederick II favored everything classical, that Italian Romanesque sculpture had its last resurgence before the advent of the Gothic, and that Nicola Pisano found his models.

Painting.—There are fewer examples left of Romanesque painting, but we can see that in this branch of art the Byzantine tradition lasted longer, especially in Venetia (mosaics of St. Mark's and the Cathedral of Torcello) and Sicily, where it is mingled with Arab themes (mosaics of the cathedrals of Cefalù and Monreale, and the Palatine Chapel in Palermo). In Latium we can still see numerous frescoes of the 11th and 12th centuries: Lower Church of San Clemente, Rome; Sant' Elia, near Nepi; Monastery of Grottaferata; and San Silvestro, Tivoli. Even more im-

pressive are those of Sant' Angelo, Formia (11th century). There are scattered Romanesque frescoes in all parts of northern Italy: crypt of the Cathedral of Aquileia; San Pietro, Civate; San Michele, Oleggio; Baptistery of Parma. The mosaics in the Baptistery of Florence are of a later date, having been begun in 1225. The newest accent in the language of Romanesque painting is found in miniatures. Among paintings on wood there are numerous crucifixes, one of the finest of which is in the Cathedral of Sarzana. In Sant' Agata, Cremona, there is a fine but almost unknown painting of St. Agatha.

At the beginning of the 13th century we can begin to distinguish the first Tuscan painters: Berlinghiero Berlinghieri, first mentioned in 1228, and Bonaventura Berlinghieri (1235), of Lucca, Giunta Pisano (fl. 1229-1254), Margheritone di Arezzo (mentioned in 1262), and Coppo di Marcovaldo, who worked in Florence from 1260 to 1271.

GOTHIC ART

Architecture.—Gothic architecture, which originated north of the Alps, began to penetrate Italy at the beginning of the 13th century. The first Italian Gothic buildings were Cistercian abbey churches: Fossanova (1208) and Casamari (1217), in Latium; San Galgano (begun in 1227), near Siena; Chiaravalle, near Milan; and Sant' Andrea, Vercelli. The principles of Gothic construction spread rapidly in Italy, but proportions differed from those of northern Europe, and there was not the same predominance of vertical lines. Italian builders preferred a more serene harmony between height and width and never attained the prodigious lacework of the northern Gothic cathedrals and their miracles of stained glass. The only exception is the Cathedral of Milan, which was begun very late, in 1386, with the aid of architects from beyond the Alps.

The rise during the 13th century of two religious orders, the Franciscans and Dominicans, stimulated the building of churches all over Italy, most of them in the Gothic style. Among them are San Francesco of Assisi (1228-1253); San Francesco (partly ruined in World War II) and San Domenico, Bologna; San Francesco of Arezzo; Santa Maria Novella (apparently begun in 1278) and Santa Croce (1294), Florence; and Santa Maria sopra Minerva, Rome. Three large cathedrals were also constructed in Gothic style: Siena, which went over into the following century; Santa Maria del Fiore, Florence, which was begun by Arnolfo di Cambio, probably the same as Arnolfo da Firenze (1232?-1302), in 1296; and Orvieto, begun around 1285.

Many nonecclesiastical buildings date from this same period. Their style is massive and closed in Florence (Palazzo Vecchio and various houses [many destroyed] and towers), winged and lacy in Venice (Ducal Palace). Almost every Italian city built a town hall at this time, and that at Piacenza is one of the most beautiful.

Early Gothic Sculpture.—Sculpture, too, took on new forms. After the middle of the 13th century the striking personality of Nicola (or Niccolò) Pisano or d'Apulia, who was both architect and sculptor, the master and teacher of the Pisan school, came into view. It is uncertain whether he received his early training in Tuscany or in southern Italy. There are many Tuscan elements in his style, but he must have been acquainted with the art that flourished at

the court of Frederick II in Palermo, the most cultivated in Italy. The head formerly on a gate and now in the Museum of Capua, the heads on the keystones of Castel del Monte near Adria, and the pulpit of Ravello appear to antedate but foreshadow Nicola's style. The first work that can be definitely attributed to him is the pulpit in the Baptistery of Pisa (1260), a massive, hexagonal piece supported by strong columns and arches and covered with sculpture. On its five panels is portrayed the cycle of the Redemption, from the Nativity to the Crucifixion and Last Judgment. The numerous figures stand out in powerful relief among deep shadows, with the folds of their garments as taut as nervures. There is growing pathos and an expansion of thick and heavy forms from Nativity to Crucifixion, and this is the subsequent direction taken by Nicola's style, as we see it in the pulpit of the Cathedral of Siena (1265-1268). Here he worked with his son Giovanni Pisano and with his pupils, Arnolfo di Cambio, Lapo, and Donato di Ricevuto. But the master's imprint is the strong unifying force, even if we see distinct traces of his assistants, especially Giovanni and Arnolfo, in some bas-reliefs. Another joint effort of the Pisan school is the tomb of St. Dominic in Bologna (c. 1264-1267), where Arnolfo's personality is more easily recognizable than in Siena.

After Siena, Arnolfo left Nicola's workshop, while Nicola and Giovanni went on working together and jointly signed the splendid Fountain of Perugia (1278). From 1284 to 1299, Giovanni worked at the Cathedral of Siena, and in particular on the lower part of the façade, with its three portals and the large statues on the cornice, which make of it the first Italian cathedral as peopled with sculptured figures as the French churches, but whose sculpture is more independent of the architectural framework. Between 1294 and 1299, Giovanni divided his time between the Cathedral of Siena and the Baptistery of Pisa, on which he had already collaborated with his father. These works were followed by the pulpit of Sant' Andrea (1301), Pistoia; that of the Cathedral of Pisa (1302-1310); and the tomb of Margaret of Luxembourg (1313), now in a fragmentary state in the Museum of Genoa. Nor must we forget the splendid groups of the Virgin and Child which we see in the Campo Santo and in Baptistery of Pisa, in the Scrovegni or Arena Chapel at Padova (Padua), and in the Cathedral of Prato (c.1317). Giovanni was as great an artist as his father was, but in an entirely different manner, more rapid and abrupt, more Gothic. He abbreviated forms by summarizing them in a single gesture and accentuated their expressiveness by the deeply cut outlines made by his chisel, creating a tense and dramatic effect.

We find the third master of the Pisan school, Arnolfo di Cambio, 10 years after his collaboration on the Cathedral of Siena, working in 1277 in the service of Charles I, king of the Two Sicilies, at Rome. Until 1295 he stayed on for the most part in Rome, where his works include the tomb of Cardinal Annibaldi in St. John Lateran, the crib of Santa Maria Maggiore, the tomb of Boniface VIII, the ciboria of St. Paul's Outside the Walls (1283), and Santa Cecilia in Trastevere (1295). In 1277 and in 1281 he was apparently in Perugia (there are fragments of a fountain and the headless statue of a scribe in the museum there) and Orvieto, where he did

the tomb of Cardinal de Braye in the Church of San Domenico. From 1296 until his death in 1302 he worked on the Cathedral of Florence, particularly the sculpture on its façade. Where Giovanni was nervous, dramatic, and immediate, Arnolfo was crystal clear and almost architectural in his forms. Modern art criticism has stressed the relationship between Arnolfo and the painter Giotto in values of volume and space.

Early Gothic Painting.—A new style was inaugurated in painting after the first great cycle of Pisan sculpture was over. The Florentine Giovanni Cimabue (properly Cenni di Pepo, fl. 1272-1302) and the Siennese Duccio di Buoninsegna (fl. 1278-1319), great masters as they are, were still linked to the Byzantine tradition. Cimabue's painting is more gaunt and severe with traces of the Romanesque, while Duccio is richer in color and ornamentation, with wavy lines reminiscent of the Gothic. Cimabue's main works are the grandiose frescoes of San Francesco of Assisi; the crucifixes of San Domenico, Arezzo, and Santa Croce, Florence; and the *Madonna Enthroned* of the Uffizi Gallery, Florence. Those considered Duccio's are the *Rucellai Madonna* in Santa Maria Novella, Florence, and the small *Virgin of the Franciscans* in the Siena Gallery. His only authenticated work, however, is the *Maestà* (*Madonna in Majesty*) of the museum of the Cathedral of Siena, dated 1308, with the life of Christ on the back, many pieces of which are scattered in foreign museums. Between these two masters we must mention an anonymous painter of Pisa, who did the fine *Madonna Enthroned* and *St. Martin* of the Pisa Civic Museum. In Rome, Pietro Cavallini, the painter to whom we owe mosaics of Santa Maria in Trastevere (1291) and the frescoes of Santa Cecilia (c.1295), left the Byzantine tradition behind him and achieved powerful chiaroscuro effects and majestic poses reminiscent of ancient art.

Giotto di Bondone (1276?-?1337), of Florence, transformed the style of painting "from Greek to Latin"—that is, into something truly Western. His contemporaries were quick to acclaim his greatness. Giotto was concise and intense; he was concerned with the human body in action, and he built basic forms of clearly defined volume with expressive gestures and positions, relinquishing the splendor of Byzantine colors in order to secure the dominance of chiaroscuro masses, and limiting his backgrounds to a few synthetic and unadorned elements. His chief works are the St. Francis cycle in the Upper Church of San Francesco of Assisi; the fine painting *Madonna Enthroned*, which is now in the Uffizi Gallery; the frescoes of the Scrovegni Chapel in Padova (c.1303-1305); the crucifix, in Santa Maria Novella, Florence; and the frescoes in the Bardi and Peruzzi chapels in Santa Croce, Florence. The last two were painted about 1320, and his outlook is more peaceful and there is a greater impression of space. Giotto worked also in Rome (mosaic, *La Navicella*, or *St. Peter's Ship*, in the entrance of Old St. Peter's, of which only fragments remain), and in Milan, Rimini, and Naples, leaving a strong influence behind him in each city. In his later years he was an architect. He began the campanile of Florence Cathedral in 1334 and raised it as high as the second story.

Giotto's followers were Taddeo Gaddi (fl. 1322-

1366); Bernardo Daddi (d. 1348); the great Maso di Banco (mentioned 1341-1350), who did the frescoes portraying St. Sylvester, notable for their limpidity, in Santa Croce; and Giotto (mentioned 1368-1369). In the latter 14th century the most important Florentine painters were Andrea Orcagna (real name Andrea di Cione, 1308?-1368), and his brother Nardo (d. 1365 or 1366). A noteworthy monument of 14th century Florence is the fresco decoration of the Cappellone degli Spagnuoli by Andrea da Firenze (fl. 1343-1377).

At this time, Siena was the center of another important school of painting, richer in color and ornamentation than that of Florence. Simone Martini (c. 1284-1344), who probably studied with Duccio, painted in bright colors against a gold background and drew figures whose bodily form is barely indicated by a slender *chiaroscuro* under draperies that flow in delicate linear arabesques. His chief works are the *Maestà* (1315) and the portrait of Guidoriccio da Fogliano, in the Palazzo Pubblico of Siena; *Louis of Toulouse Crowning His Brother Robert of Naples*, in the Naples Gallery (1317); the Sant' Ansano *Annunciation* in the Uffizi Gallery (1333); and the frescoes portraying St. Martin, in the Lower Church of San Francesco of Assisi. After 1339 he was at Avignon, and the work he did there, which is largely lost, had great influence in France and laid some of the groundwork for the so-called international Gothic style.

The brothers Pietro Lorenzetti (also called Pietro Laurati or Laurati da Siena, first dated work 1315-d.-1348) and Ambrogio Lorenzetti (Ambrogio di Lorenzo, mentioned 1332-d.-1348) are more plastic than Simone but more ornate than Giotto. They drew lines around their figures to bring out their depth, and both of the brothers, but especially Ambrogio, had splendid rhythms. Many of their paintings are to be seen in the churches and galleries of Siena, Florence, Vico l'Abate, and other cities. Pietro did frescoes in the Lower Church of San Francesco of Assisi, and Ambrogio in the Palazzo Pubblico of Siena (allegory of *Good and Bad Government*).

Northern Italy, too, had important though lesser known schools of painting in the 14th century. Giotto's influence was felt, but it was transformed by a more empirical, intimate, and narrative local tradition. Among the fine frescoes extant in Lombardy are those at Viboldone, Solaro, Chiaravalle, Vertemate, and Mocchirolo. A leading artist of Lombardy was Giovanni da Milano (fl. 1350-1369), who came there after his Florentine period (1350-1366), during which he had painted the frescoes of the Rinuccini Chapel in Santa Croce.

In 14th century Padova there was a lively and original group of artists, including Guariento, a pupil of Giotto; Giusto di Giovanni di Menabuoi of Florence (d. before 1393), author of the series of frescoes in the baptistery and of those, unfortunately now destroyed, of the Palazzo del Podestà and the Eremitani, with their strictly theological themes; and, a little later, Altichiero or Aldighero da Zevio (1330?-1400) from Verona together with his assistant, Jacopo Avanzo, who collaborated on the frescoes of Sant' Antonio and the oratory of San Giorgio (after 1377). Giotto's stay in Rimini gave rise to a local school of painting, which in its turn influenced a school of Bologna, whose major exponent was the sensitive and clever Vitale Cavalli (mentioned 1334-

1359). Tommaso da Modena (c.1329-1379) had some stylistic resemblance to Vitale, but a different personality, for he was gifted in characterization rather than imagination. He did the frescoes of *Dominican Monks* in the chapter house of San Niccolò at Treviso and the stories of St. Ursula in the museum of the same city. Meanwhile in Venice the Byzantine tradition still prevailed, exemplified by Maestro Paolo and Lorenzo Veneziano (fl. 1356-1379).

Later Gothic Sculpture.—The Pisan school of sculpture continued in the first half of the 14th century. In Naples its tradition was carried on by Tino di Camaino (fl. 1312-1337) of Siena, a pupil of Giovanni Pisano, who was active in Pisa, Siena, and Florence. His Neapolitan works (1325-1337) are the Anjou tombs in Santa Chiara and Santa Maria Donna Regina. In Milan Giovanni di Balduccio of Pisa was author of the tomb of St. Peter Martyr, in Sant' Eustorgio (1339). Of a style akin to that of the Pisan school are many early 14th century sculptures in Umbria, among which the most splendid are those on the façade of the Cathedral of Orvieto, attributed to Lorenzo Maitani, who was the superintendent from 1310 to 1330, and those at Ramo di Paganello.

We may relate to these sculptures the obscure origins of Andrea Pisano (also called Andrea da Pontedera, died in 1348), whom we find for the first time in his maturity at Florence in 1330, charged with the execution of the bronze doors of the baptistery, where he carved the story of St. John the Baptist and the cardinal virtues. Andrea shows keen awareness of linear rhythm in his flowing robes, but the most conspicuous parts of his bodies are carved in a refined, synthetic archaic style. Andrea was certainly acquainted with the French art of his time, but he must also have learned from Giotto a new kind of composition and space relationship, which he softened in adapting it to his own talents. The work of these two artists crossed in the campanile of Florence Cathedral, where Andrea Pisano succeeded Giotto as superintendent and, with some assistance, carved most of the bas-reliefs of the lower part of the tower, which represent the story of Genesis and the mechanical arts. According to tradition, these were first sketched by Giotto, who is supposed to have carried some of them out, but this is a controversial and unsupported claim. The bas-reliefs of *Weaving*, *Horseback Riding*, *Hercules and Cacus*, *Navigation*, and *Agriculture* are among the finest ever produced in Italy. In 1347-1348, Andrea was in charge of the Cathedral of Orvieto. He was succeeded there by his son Nino (died in 1368), a graceful but somewhat artificial sculptor (*Madonna* in Santa Maria Novella, Florence; Cornaro tomb in Santi Giovanni e Paolo, Venice).

After Andrea Pisano, the leading place in the field of Florentine sculpture passed to Andrea Orcagna, who carved the tabernacle at Or San Michele (1358-1360). In Pavia, Milan, and Verona (della Scala or Scaligeri tombs), we find the Maestri Campionesi; in Venice, the brothers Jacobello (mentioned to 1409) and Pier Paolo (d. 1403) dalle Masegne (statues of the rood screen of St. Mark's, c.1394), which are in the most ornate Gothic style.

Later Gothic Painting.—The ornate Gothic style, called international because of the common characteristics it had in various parts of Europe, was marked by a progressive diminution

of plastic forms and an overabundant development of rhythmically flowing draperies. This style is considered predominantly northern, but the two greatest painters are the Italians Gentile da Fabriano and Pisanello.

Gentile da Fabriano (real name Gentile Massi, died in 1427) came from Marche, where the Gothic style had been made widely known. He worked all over Italy, but particularly in Venice and Rome. Unfortunately, neither his frescoes in the Ducal Palace nor those in St. John Lateran have survived. Such of his paintings as do remain prove him to have been a master of the delicate touch: *Adoration of the Magi* (Uffizi Gallery), and Madonnas of Orvieto, Milan, and the National Gallery, London.

Antonio or Vittore Pisano (il Pisanello, b. before 1395-d. 1455), was trained in the school of Verona (of which the chief figure was Stefano da Zevio, c.1374-1451), which was characterized, like all Lombard painting of the first half of the 15th century (for example, Giovannino de' Grassi, died in 1398; the brothers Zavattari; Bonifazio Bembo; Michelino da Besozzo), by an ornate Gothic style, but he was also inspired by Gentile da Fabriano. The works of Pisanello still preserved include the frescoes of San Fermo (*Annunciation*) and Sant' Anastasia (*St. George and the Princess*), Verona, *Portrait of a Princess* in the Louvre, Paris, *Lionello d'Este* in the Accademia Carrara at Bergamo, and a considerable number of fine drawings. Pisanello was also an excellent engraver and coined medals and medals for all the princes of Italy.

In Venice, too, painting continued to be in an ornate Gothic style despite a few hesitant foreshadowings of the Renaissance. The greatest masters were Antonio Vivarini (Antonio da Murano, died 1476-1486), who painted the *Madonna Enthroned* (1446) in the Venice Academy in collaboration with Giovanni d'Alemagna (fl. 1440-1447), a triptych at San Zaccaria, and various Madonnas; and Iacopo Bellini (c.1400-c.1470), who is represented by Madonnas in the Louvre, the Venice Academy, and the Uffizi Gallery, and by sketchbooks in the Louvre and the British Museum. Vivarini and Bellini were the respective heads of two families that divided the field of Venetian painting between them.

Even in Florence, both Lorenzo Monaco (called Don Lorenzo, c.1370-1425) and Masolino da Panicale (1383?-1447), who has been identified with Tommaso di Cristoforo Fini, were essentially Gothic. But here it was, while the rest of Italy continued for a number of years to follow the late Gothic style, that at the beginning of the 15th century three major artists—Filippo Brunelleschi, Donatello, and Masaccio—brought about a revolution in style that developed into the Renaissance.

THE RENAISSANCE

The Renaissance period of Italian art extended from the early part of the 15th century to the latter part of the 16th century. In the early Renaissance, Florence was the leading artistic center of Italy. Later, Rome was pre-eminent, and then, Venice.

Early Florentine Architecture.—Filippo Brunelleschi or Brunellesco (1377?-1446) was not only the greatest Italian architect of the 15th century, but also the first to establish the scientific theory of perspective, which, when applied to the arts, became the basis of Renaissance style.

All during the 14th century a feeling for space had been notable in the Florentine school, but this was largely a matter of intuition. Through the use of perspective, spaces could be constructed geometrically, with harmoniously proportioned partitions. Brunelleschi's buildings are the most enlightening example of this development. From the outside they show a clear outline of volumes, while within a large, unencumbered space gradually unfolds before the eye in the rhythm of various planes and a succession of pauses. Together with this impression of space, Brunelleschi's buildings retain the almost elastic tension of the Gothic style and the slenderness and movement of its forms. At one time, Brunelleschi's style was attributed to the study of classical models, but in recent years it is more frequently considered close to the Romanesque—for example, to the Baptistery of Florence and San Miniato—or to the Gothic architect Arnolfo di Cambio. Brunelleschi's chief works are the dome of Florence Cathedral; the Church of San Lorenzo with the old sacristy; the Pazzi Chapel, in the cloister of Santa Croce, an architectural jewel which is entirely his own; the Church of Santo Spirito; and the Pitti Palace, which underwent many changes in the 16th century.

Brunelleschi influenced all the other Florentine architects of his time. They include Michelozzo or Michelozzi di Bartolommeo (1396-1472), who designed the Careggi Villa and the Medici-Riccardi Palace in Florence; Giuliano da Maiano (1432-1490); Benedetto da Maiano (1442-1497), known for Santa Maria delle Grazie at Arezzo and the Strozzi Palace in Florence; Giuliano da Sangallo (1445-1516), builder of Santa Maria delle Carceri at Prato and the sacristy of Santo Spirito in Florence; Simone Pollaiuolo, known as il Cronaca (1454?-1508), author of the Church of the Saviour at San Miniato.

Architects who broke away from the Brunelleschi tradition were Leon Battista Alberti (1404-1472), who had a more classical and solemn style, which we see in the façade of Santa Maria Novella and the Rucellai Palace in Florence, the Church of San Francesco (Malatesta Temple), partly destroyed in World War II, at Rimini, and Sant' Andrea at Mantova. Alberti wrote three treatises: *De pictura* (1436), *Della statua*, and *De architettura*. One of his followers was Bernardo Rossellino or Rossellini (1409-1464), who designed the Palazzo Pubblico, Piccolomini Palace, and Cathedral of Pienza, and there are traces of Alberti's style in Luciano da Laurana (fl. 1468-1482), who reveals, however, a personality of his own in the purity of the Ducal Palace of Urbino.

Early Florentine Sculpture.—Donatello (real name Donato di Niccolò di Betto Bardi, 1386?-1466), the great innovator in the field of Florentine sculpture, was one of Brunelleschi's closest friends. His contemporary, Lorenzo Ghiberti (originally Lorenzo di Cione di Ser Buonaccorso, 1378-1455), continued with an older style, extremely delicate and sensitive to decorative, linear rhythms. Ghiberti's chief works are the two gold-covered bronze doors of the Baptistery of Florence, 1403-1424 and 1425-1452), executed with all the delicacy of a goldsmith, which was his real trade. The first door is close to the plans of Andrea Pisano, the second definitely more Renaissance in feeling.

Donatello emerged from the group of late Gothic sculptors working on the Florence cathe-

dral—Nanni d'Antonio di Banco (1374–?1420) among them—and based his sculpture on opposition to the refined elegance of the Gothic tradition. Donatello emphasized the plastic element in his art. He favored realistic forms and brusque motions. In a clear manner Donatello applied Brunelleschi's principles of perspective to the bas-relief, causing his forms to melt into space by telescoping one plane into another and modeling with a rapid, impressionistic, and lively touch. His main works are the *St. George* (1416) now in the Bargello; the statues on the campanile of the cathedral, the *Annunciation* in Santa Croce; the *cantoria*, or singers' gallery, of the cathedral; the ceiling medallions and bronze doors of the old sacristy of San Lorenzo, all in Florence; the statue of Erasmo da Narni, called Gattamelata, in Padova, where he worked from 1443 to 1453, exercising a notable influence on local art, especially that of Mantegna; and the late pulpits of San Lorenzo (in Florence again).

Donatello's influence was supreme among 15th century Florentine sculptors—such men as Michelozzo, who was one of his collaborators; Bernardo Rossellino (tomb of Leonardo Bruni in Santa Croce); Desiderio da Settignano (1428–1464), the most sensitive of the group, author of many *putti* and groups of the Virgin and Child; Mino da Fiesole (1431?–?1481); Antonio Rossellino (1427–?1479); and Benedetto da Maiano. A sculptor who remained aloof from the Donatello tradition was Luca della Robbia (1400?–1482); he discovered the possibilities of glazed terra cotta, which became a specialty of his family.

Another celebrated member of the generation of Ghiberti and Donatello was Jacopo della Quercia (1378?–1438), a Sienese, equally great in spite of the fact that he attracted a lesser following. He worked at first in the late Gothic style, but soon added to it a plastic strength that swelled his forms with power, while still preserving their flowing sinuosity. In Siena, della Quercia did the Fonte Gaia as well as a bas-relief on the baptismal font of the cathedral. He also did the tomb of Ilaria del Carretto in the Cathedral of Lucca (1406) and the famous portal of San Petronio in Bologna.

Early Florentine Painting.—Masaccio (real name Tommaso Guidi, 1401–1428), a contemporary of Brunelleschi and Donatello, achieved something profoundly new in the field of painting. He was a spiritual descendant of Giotto, favoring forms stripped to their essentials, strong chiaroscuro effects, and a muted intensity of gestures and motions. He took over Brunelleschi's discovery of perspective and laid out his spaces and the figures peopling them in such a way as to focus attention on the center of action. The frescoes of the Brancacci Chapel in Santa Maria del Carmine in Florence are his greatest achievement. Here he had Masolino da Panicale as a collaborator, but his own influence was far stronger than that of the older man. His scenes include the *Expulsion from the Garden*, the *Tribute Money*, *St. Peter Healing the Sick*, and *St. Peter Distributing Alms*. Other of Masaccio's works are the painting of *St. Anne* in the Uffizi Gallery; the altarpiece originally in the Carmine Church at Pisa, now scattered among galleries in Pisa, London, Naples, and other cities; the fresco of the *Trinity* in Santa Maria Novella; part of the Crucifixion in San Clemente in Rome; and a few others.

Up to the time of Michelangelo all the Florentine painters studied the Brancacci frescoes, among them Fra Giovanni da Fiesole, known as Fra Angelico (1387–1455), usually praised for his religious feeling but not sufficiently valued for his great artistic importance. He probably began as a miniaturist, in a manner akin to that of Lorenzo Monaco, but soon developed a radiant style of painting where enamel-like colors are combined with bright spaces, and planes are made to stand out by means of the light falling upon them, and delicately drawn figures are caught in postures of exceeding grace. Fra Angelico worked at Fiesole, Cortona, Florence (whose Convent of San Marco, where he left frescoes in every cell, has been turned into a personal museum), Orvieto, and Rome (frescoes of the Chapel of Nicholas V in the Vatican).

Fra Filippo (or Lippo) Lippi (1406?–1469) is generally associated with Fra Angelico, although he was equally subject to the influence of Masaccio (*Coronation of the Virgin* in the Uffizi Gallery and frescoes in the Cathedral of Prato). Other prominent 15th century Florentine painters were Paolo Uccello (real name Paolo di Dono, 1397–1475), a master of perspective and author of battle scenes in the Uffizi Gallery, Louvre, and the National Gallery of London, as well as the frescoes in the Green Cloister of Santa Maria Novella; Andrea del Castagno (1423–1457), who had a rough but clear-cut style and painted frescoes in Sant' Apollonia, the Villa Pandolfini (now at Sant' Apollonia), and in S. Annunziata; and Domenico Veneziano (c.1400–1461), noted for his powerful drawing and luminous colors (*Santa Lucia* altarpiece in the Uffizi Gallery).

Piero della Francesca (real name Piero dei Franceschi, 1420?–1492) became an apprentice of Domenico Veneziano and achieved a "synthesis of perspective, form, and color" to be seen in his frescoes of the *Story of the True Cross* in San Francesco, Arezzo; the *Baptism of Christ*, National Gallery, London; the altarpiece at his birthplace, Borgo San Sepolcro; the *Flagellation* in the Ducal Palace of Urbino; and the portraits of Federico da Montefeltro and Battista Sforza in the Uffizi Gallery. Piero, in his turn, influenced Alessio Baldovinetti of Florence (1425?–1499); Melozzo da Forlì (1438–?1495), who painted frescoes in Loreto and Rome; Il Perugino (real name Pietro Vannucci, also called Pier della Pieve, 1446–1523); and Luca d'Egidio di Ventura de' Signorelli (also called Luca da Cortona, 1441–1523), who owes some of his dynamic movement and anatomical knowledge to Antonio Pollaiuolo, and is known for his frescoes in the Cathedral of Orvieto.

Toward 1460 two Florentine masters stood out above the rest: Antonio Pollaiuolo (1429–1498) and Andrea del Verrocchio or Verocchio (real name Andrea di Michele Cione, 1435–1488), both of whom combined painting and sculpture. Pollaiuolo's preferred theme was the nude in motion, sketched in strong and incisive outlines. Among his paintings are the *Hercules and Antaeus* and *Hercules and the Hydra* in the Uffizi Gallery, the *Martyrdom of St. Sebastian* in the National Gallery, London, and *Tobias and the Archangel* in the Turin Gallery. His sculptures include the *Hercules and Antaeus* of the Bargello, Florence, and the tomb of Sixtus IV in the Vatican, Rome. Verrocchio, too, in contrast to the preceding generation, stressed an anatomical treatment of the body and dealt with it in hard outlines, but with

less tension than did Pollaiuolo. On the other hand, he lingered more over detail, displayed greater psychological insight and deeper study of chiaroscuro. Among his sculptured works are the sarcophagus of Giovanni and Piero de' Medici in San Lorenzo, the bronze *David* and marble *Bust of a Woman* in the Bargello, the Fountain of the Palazzo Vecchio, and *Christ* and *St. Thomas* on the outside of Or San Michele (all in Florence), and the monument to Bartolomeo Colleoni in Venice. Among his paintings are the *Baptism of Christ* (done with Leonardo) in the Uffizi Gallery, the *Madonna and Child* in the Museum of Berlin, and an altarpiece in the Cathedral of Pistoia.

Sandro Botticelli (originally Alessandro di Mariano dei Filipepi, 1444?-1510) came under the influence of Pollaiuolo and Verrocchio and was a pupil of Filippo Lippi. His lines are poetic and graceful with fine decorative rhythm and he conveys a feeling of melancholy and meditation: *Madonnas*, portraits, *La Primavera (Spring)*, and *Birth of Venus*, in the Uffizi Gallery. There was an almost endless number of painters in Florence in the 15th century; let us note further Domenico di Tommaso Bigordi, known as Ghirlandajo (1449-1498), who painted portraits and frescoes in Santa Maria Novella and Santa Trinità; Filippino Lippi (1457?-1504), who was the son of Filippo and a bizarre and unequal painter; and Piero di Cosimo, or di Lorenzo (1462-1521), who had an even more lively style, influenced by that of Leonardo.

Early Non-Florentine Art.—Away from Florence the arts also flourished, but not always in so continuous and coherent a fashion. The Sienese painters favored extremely delicate but more traditional forms, as in the work of Stefano di Giovanni, called Il Sassetta (1392-1450), Giovanni di Paolo (1403?-c.1482), and Neroccio di Bartolommeo di Benedetto de' Landi (1447-1500). Domenico di Bartolo (c.1400?-1447) and Matteo di Giovanni di Bartolo (1434-1495) came under the spell of the Florentine school, and in sculpture Lorenzo di Pietro, known as Vecchietta (c.1412-1480), and Francesco di Giorgio (in full Francesco Maurizio di Giorgio Martini, or di Martino, Pollaiuolo 1439-1502), who in addition did architectural work at the court of Urbino, were influenced by Donatello.

In northern Italy, Gothic forms continued side by side with Renaissance encroachments. In Venice, for instance, at the beginning of the 15th century architecture still had a completely Gothic character, as in the Cà d'Oro and the Cà Foscari. It was considerably later in the century that Antonio Rizzo (or Rizzi or Rizo, 1430?-1498) and Pietro Lombardo or Lombardi (real name Solaro, c.1435-1515), aided by his sons Antonio (c.1458?-1516) and Tullio (c.1455-1532), introduced the Renaissance style, which we see in the Foscari Arch and the Giants' Staircase in the Ducal Palace (Rizzo) and Santa Maria dei Miracoli (Lombardi). These men were also responsible for a new trend in Venetian sculpture. This had hitherto been dominated by the elaborate late Gothic style, as represented by the sculptors from other regions who worked on St. Mark's and the Ducal Palace, and also by a native Venetian Bartolomeo Buon or Buono (also Bon or Bono, d. 1464), who carved the *Four Virtues* of the Porta della Carta. Pietro Lombardi is chiefly remembered for the tomb of Pietro Mocenigo (1476) in Santi Giovanni e Paolo, and Rizzo for the monument to the doge Niccolò Tron in

Santa Maria dei Frari (1473), completed by others, and the splendid *Adam and Eve* of the Foscari Arch of the Ducal Palace.

In Lombardy, Tuscan architects undertook much work in the 15th century: Ospedale Maggiore of Milan (seriously damaged in World War II) by Filarete (real name Antonio di Pietro Averlino or Averulino, 1400?-1470), and the Portinari Chapel in Sant' Eustorgio, also in Milan, by Michelozzo. Giovanni Antonio Amadeo or Omodeo (1447-1522), architect and sculptor, was the chief Lombard artist, designer of the Colleoni Chapel at Bergamo and the façade of the Certosa (Carthusian Monastery) of Pavia, both extremely ornate. In the latter half of the century, the chief influence on Lombard architecture was that of Bramante.

As the Renaissance slowly made itself felt in Lombard painting, this took on an empirical naturalism and love of detail, together with a strong leaning for effects obtained from outlines of light. Vincenzo Foppa (c.1427-1515) was the leader of the Lombard school. Other painters were Bernardino Zenale (1436-1526) and Bernardino Butinone (1436-1507), authors of the altarpiece in San Martino, Treviglio; Ambrogio da Fossano, known as Bergognone or Borgognone (c.1450-1523), who was very active at the Certosa of Pavia; Gian Martino Spanzotti (mentioned 1480-1524), founder of the school of Vercelli; and Gaudenzio Ferrari (1484?-1546), who painted the frescoes of the Sacro Monte of Varallo and worked at San Cristoforo, Vercelli, and the Sanctuary of the Beata Vergine at Saronno, in addition to executing several altarpieces in churches and galleries of Lombardy and Piedmont.

In Padova, the school that came into being after the sojourn of Donatello was dominated by Andrea Mantegna (1431-1506), who had a conscious enthusiasm for classical antiquity and interpreted it in a style still marked by a certain Gothic crudity, with clear-cut, writhing, and violently foreshortened figures, monumental antique backgrounds, and architectural frameworks. Mantegna is known for the frescoes of the Eremitani of Padova, destroyed during World War II, and the bridal chamber of the Ducal Palace of Mantova. There are links with the school of Padova in the style of the Venetian painter Carlo Crivelli (1430?-1494), long active in Marche and author of many valuable *Madonnas*, and in Cosmè Tura (1430?-1495), the earliest of the masters of Ferrara, who was followed by Francesco del Cossa (1438?-1480) and Ercole de' Roberti (c.1456-1496). In Venice, Mantegna had a deep influence on Bartolommeo Vivarini, originally da Murano (1432?-1491), brother of Antonio (1415?-1470) and uncle of Alvise Vivarini (1446?-1503), and on the two sons of Jacopo Bellini. Gentile Bellini (1429?-1507) retained in his style an archaic element of distant Byzantine origin (organ doors in the Opera di San Marco), and later revealed a narrative vein akin to that of his pupil, Carpaccio, painting cycles of holidays, miracles, and processions: canvases formerly in the Scuola di San Giovanni Evangelista and now in the Venice Academy. His brother, the great Giovanni Bellini (c.1431-1516), in the course of his long career, moved away from the influence of Mantegna.

Leonardo, Michelangelo, and Raphael.—Toward the end of the 15th century the marked

differences among the local schools began to diminish. Increasing exchanges between northern and central Italy, the prevalence of the same artistic problems among all artists, and, above all, the dominance of several outstanding personalities made for greater unity and easier communication among the various regions. In this way Italian art acquired a national character and served as a guide and model to the rest of Europe.

This second stage of the Renaissance was opened by Leonardo da Vinci (1452-1519), a pupil of Verrocchio, who displayed in his very first works a magical use of chiaroscuro, an originality, loftiness, and graceful expression of ideas that set him at once head and shoulders above his fellow pupils, chief among whom was Lorenzo di Credi (1459-1537): *Annunciation* and *Adoration of the Shepherds* (Uffizi Gallery), a *Madonna* (Leningrad), and a *Portrait of a Lady* (Liechtenstein Gallery of Vienna). Leonardo spent the years from 1482 to 1499 in Milan in the service of Lodovico Sforza. He was a painter (*Madonna of the Rocks*, now in the Louvre, with another version in the National Gallery of London; *Last Supper*, which has worn badly, in Santa Maria delle Grazie, in Milan); sculptor (monument to Francesco Sforza, of which he did only a clay horse, which was, unfortunately, shortly destroyed by the French invaders); musician; organizer of parties and masquerades; mathematician; and architect and engineer. In every field to which he turned his hand he had no rival. When Lodovico was driven out by the French, Leonardo returned via Mantova and Venice to Florence. Here, in 1503, he was asked by the Signoria to compete with Michelangelo for a painting in the Palazzo Vecchio: Battle of Anghiari. He made a sketch but never did the mural. From this same period date the *Cartoon of St. Anne*, now in the Royal Academy of London (the Louvre painting—*Madonna with Christ Child in the Lap of St. Anne*—came later), and the famous *La Gioconda*, or *Mona Lisa*, in the Louvre.

Leonardo went further and further into study and research, with the result that he has left us a number of wonderful drawings (Uffizi Gallery, Louvre, British Museum, Windsor Castle, and other museums) and manuscripts, rediscovered and published in the 20th century, which furnish a mine of ideas, experiments, inventions, and prophecies in every field of science: *Codice Atlantico* (*Codex Atlanticus*) in the Ambrosian Library of Milan, manuscripts at the Institut de France, *Codice del Volo degli Uccelli* (*Treatise on the Flight of Birds*) in Turin, notebooks on anatomy at the Royal Library of Windsor.

Leonardo returned to Milan in the service of King Louis XII of France and stayed there from 1506 to 1513, except for the year 1507-1508, which he spent in Florence. After this he went to Rome, and in 1516 to France, where he died. In his art Leonardo went beyond the carefully drawn and circumscribed forms of the Florentine tradition. His edges were less clearly defined, while his atmosphere was enveloping, and deep shadows made the figures emerge in a mysterious way and seem possessed of a new spiritual complexity. His interest extended not only to man but to the whole universe as well.

Michelangelo Buonarroti (1475-1564), on the other hand, raised man, particularly in the representation of the nude, to new heights. He, too,

was at once painter, sculptor, and architect. As a very young man he frequented the Medici Garden with its collection of antique sculpture, and his very first work, the *Battle of the Centaurs*, contained the essence of his whole vision: a group of nude figures in combat with taut muscles standing out in relief. There followed the *Madonna of the Steps* in the Casa Buonarroti in Florence, the *Kneeling Angel* and *St. Proculus* and *St. Petronius* for the tomb of St. Dominic in Bologna, the *Bacchus* (Bargello), the *Pietà* in St. Peter's, the *David* (Bargello), the round bas-reliefs of the Royal Academy of London and the Bargello and the round painting of the Uffizi Gallery of Florence, and the unfinished *St. Matthew* of the Florence Academy.

In 1505, Michelangelo was called to Rome to build the tomb of Pope Julius II. He drew up a grandiose plan for a miniature temple under the roof of St. Peter's but eventually had to reduce it to the architectural structure dominated by the figure of Moses which was placed in San Pietro in Vincoli in 1546. The two figures of slaves now in the Louvre were intended to go on this tomb, as were the four unfinished slaves of the Florence Academy. Julius II himself made it difficult for Michelangelo to complete this work by assigning him soon afterwards the decoration of the ceiling of the Sistine Chapel (1508-1512). This gigantic work tells the story of Genesis, framed by magnificent nude festoon bearers and great figures of sibyls and prophets, which had a revolutionary influence on painting. The unveiling of the ceiling was witnessed by everyone of importance in Rome and its influence spread at once all over Italy. Later Michelangelo painted the *Last Judgment* on the altar wall of the chapel and the *Martyrdom of Peter* and *Conversion of Paul* in the Pauline Chapel (1542-1550), but these did not add any new element to his fame or touch the heights that he had reached earlier. Michelangelo at this point went back to sculpture and architecture.

Raphael (Raffaello Santi or Sanzio, 1483-1520) came in between the two great figures of Leonardo and Michelangelo. He was born in Urbino, an important artistic center of the 15th century, known for the work of Piero della Francesca, Melozzo da Forlì, Luciano da Laurana, Francesco da Laurana (c. 1425-1502), Francesco di Giorgio Martini, and others. He was a pupil of Perugino, and between 1500 and 1504 he painted in a style very much like that of his master, but radiant with youthful freshness and incomparable virtuosity (*Marriage of the Virgin* in the Brera Gallery at Milan, *Coronation of the Virgin* in the Vatican Gallery).

In 1504, Raphael went to Florence, where both Leonardo and Michelangelo were then active. He was quick to appreciate the quality and newness of their styles and to modify his own, which he modeled upon that of Leonardo. During the next years he painted a series of Madonnas—the *Madonna del Granduca* (Pitti Palace), the *Madonna del Cardellino* (Uffizi Gallery), *Madonna of the Meadow* (Vienna), *Madonna and Child with the Little St. John* (Dahlem Museum, Berlin), and *La Belle Jardinière* (Louvre)—and the portraits of Angelo and Maddalena Doni (Pitti Palace) and of Tommaso Inghirami (Gardner Coll., Boston). In 1508, he was called to Rome by Pope Julius II to paint frescoes in the Vatican: Stanza della Segnatura (1509-1511), Stanza d'Eliodoro (1511-1514), Stanza

dell' Incendio di Borgo (1514-1517), Sala di Costantino (1517-1524, executed by his pupils). His style at this point attained the solemn proportions of the portrayals of the *School of Athens*, *Expulsion of Heliodorus from the Temple*, and the *Mass of Bolsena*. Here he seems to have drawn upon Venetian coloring, which he may have learned from Lorenzo Lotto (a collaborator in the Stanza della Segnatura) even before the arrival in Rome about 1509-1511 of Sebastiano del Piombo, a pupil of Giorgione. At a later period the attempt to imitate Michelangelo caused a certain strain to appear in Raphael's style (Stanza dell' Incendio del Borgo and the *Transfiguration* in the Vatican Gallery). As a whole, however, his work is a monument of harmony and balance, intellect and culture.

Raphael's portraits are also remarkable: *Cardinal* (Prado Museum, Madrid), *Baldassare Castiglione* (Louvre), *Donna Velata* and *Leo X* (Pitti Palace). Another excellent portraitist was Sebastiano del Piombo (real name Sebastiano Luciani, 1485?-1547), who worked at the Villa Farnesina in Rome in 1512-1514, at the same time as Raphael, but in style came closer to Michelangelo: *Flagellation* in San Pietro in Montorio, *Deposition* in the Viterbo Museum. Raphael had several direct pupils—Giulio Romano (real name Giulio Pippi de' Giannuzzi, 1499-1546), who went to Mantova in 1524 and was very active there as both architect and painter; Gianfrancesco Penni, known as Il Fattore (1488?-1528); and Perino del Vaga (real name Pietro Buonaccorsi, 1501-1547). Raphael's influence was felt all over Italy to an extent surpassed only by that of Michelangelo.

Later Florentine and Northern Italian Painting.—While the greatest artists were flocking to Rome, Florence was falling from the position of capital of Italian art which it had acquired in the 15th century. It could still boast such masters as Fra Bartolommeo della Porta (Bartolommeo di Pagolo de Fattorino, 1475-1517) and Andrea del Sarto (real name Andrea Domenico d'Angnolo di Francesca, 1486-1531), who tried each in his own way to blend Leonardo's chiaroscuro with the form of Michelangelo, but in general Florentine art had taken on a provincial tone.

After 1512 there came a sort of crisis, in the form of mannerism, which spread throughout Italy as more and more people came to know the ceiling of the Sistine Chapel. Jacopo da Pontormo (real name Jacopo Carrucci, 1494-1557), a pupil of Andrea del Sarto, was led by natural sensibility and dissatisfaction with the naturalistic and chiaroscuro effects of the traditional Florentine manner to adopt a certain stylistic exasperation, but at the same time he displayed a new and untrammelled imagination. Among his works are the *Deposition* in the Church of Santa Felicità in Florence, frescoes at Poggio a Caiano and the Certosa, and many portraits. Il Rosso or Il Rosso Fiorentino (real name Giovanni Battista de' Rossi, 1494-1540) had some points in common with Pontormo, but his chief successor in the field of portraiture was his pupil Il Bronzino (real name Agnolo or Angiolo di Cosimo, 1503-1572), who painted in a more formal vein. Other members of the mannerist school were Domenico Beccafumi (originally Domenico di Pace, 1486-1551) of Siena, called Il Meccherino, and Il Parmigianino or Parmigiano (real name Girolamo Francesco Maria Mazzuoli or Mazzola,

1503-1540), an extremely graceful artist who painted the frescoes in the Castle of Fontanellato and the Church of the Steccata in Parma, and various portraits.

Parmigianino was a pupil of Correggio and came from northern Italy, where, toward the end of the 15th century, artistic trends as important as those at Rome developed. Correggio (Antonio Allegri da Correggio, 1494-1534) was trained in the school of Ferrara but was largely influenced by Mantegna and the delicate chiaroscuro of Leonardo, as is seen in the *Campori Madonna* in the Modena Gallery, the *Zingarella* in the Naples Gallery, and *Madonna Blessing St. Francis* at Dresden. Later he felt the influence of Rome and his style developed with the frescoes on the ceiling of the Convent of San Paolo in Parma (1518), those of the cupola of San Giovanni, Parma (1520-1523), and of the Cathedral of Parma (1526-1530), where the vault gives the illusion of breaking through and opening on figures daringly projected into space and foreshortened in order to achieve perspective. This original concept had an enormous influence in the following years. Here we may see the beginning of the fluttering veils and draperies and the glimpses of sky with which the baroque painters decorated domes and ceilings.

In his later period, Correggio did a great many altar panels—*Madonna della Scodella* and *Madonna with St. Jerome* in the Parma Gallery, *Madonna and St. George* and the *Holy Night* or *Nativity* of Dresden—and a number of mythological compositions—*Ganymede* and *Io and Jupiter* (Vienna), and *Danaë* (Borghese Gallery in Rome), a gay and voluptuous vision, softened by the marvelous flexibility of the figures and the delicate use of chiaroscuro.

Venetian Painting.—In Venice during the last quarter of the 15th century there came into being a school which by its unity and originality was equal to the earlier school of Florence. This Venetian movement was still in full flower when the group in Rome had passed its prime. The Venetian painters of the Renaissance obtained effects of depth through the use of colors rather than line, blending them in aerial perspective and creating a new relationship between light and shadow. Their figures were wrapped in an enveloping atmosphere and stood out without rigid outlines. The effect was intimate and natural rather than abstract and rational as had been true of the Florentines. Landscape also assumed a new importance.

The painter who began this movement was Giovanni Bellini. Around 1475, after the altarpiece *Coronation of the Virgin* at Pesaro, he drew away from the influence of Mantegna and achieved more open spaces with softer and more sculptured forms. This change of style is generally attributed to the influence of Antonello da Messina (1430?-1479), who had become acquainted in Naples with Flemish painting and doubtless also knew the work of Piero della Francesca. After working for a time in the south (*Annunciation and Madonna with Saints Gregory and Benedict* in the Museum of Messina), Antonello came to Venice (1475-1476), where his lost altarpiece of San Cassiano served as a model for Venetian painters for the next 20 years. Antonello was also a first-rate portraitist, witness the examples in the Louvre, the Castle of Milan and the Civic Museum of Turin.

It is equally probable, however, that the modi-

fication of Bellini's style was coincidental rather than derived. This phase of Bellini inspired the rustic and serene Giovanni Battista Cima, called Cima da Conegliano (c.1459–1517 or 1518), and Bartolommeo Montagna of Vicenza (1450?–1523). During his next period (San Giobbe altarpiece, Santa Maria dei Frari triptych of 1488, the *Baptism* in Santa Corona at Vicenza of 1502, and the altarpiece of San Zaccaria of 1505), he influenced Giorgione and Titian and in his turn, was influenced by them (*Lady at Her Toilet* in Vienna and *Feast of the Gods* in the Widener Collection, Philadelphia). Bellini painted an enormous number of pictures, which are scattered in museums on both sides of the Atlantic. His contemporary, Vittore Carpaccio (b. before 1460–d. before 1526), painted in a vein of story and fable, immersing his narratives in an atmosphere of life and light (*History of St. Ursula* in Venice Academy, 1490–1500; scenes of St. George and St. Jerome, San Giorgio degli Schiavoni).

Il Giorgione or Giorgione da Castelfranco (originally Giorgio Barbarelli, c.1478–1510) is generally considered the creator of tonal painting, but this innovation was previously evident in the late Bellini and Carpaccio. Giorgione accentuated atmospheric effects and a blending of colors harmonized in one dominant tone in such a way as to express a dreamlike and poetic vision. He originated and developed a taste for nonreligious themes, rich in allusions and naturalistic touches, and for pictures of small size which were acquired by individual collectors. His larger paintings include the altarpiece *Enthroned Madonna* at Castelfranco, the *Judith* in Leningrad, *The Storm* in the Giovannelli Gallery, Venice, *The Three Philosophers* in Vienna, the *Portrait of a Young Man* in Berlin, the *Fête Champêtre* of the Louvre, and the *Venus* of Dresden. These last two works are often attributed to Tiziano Vecelli or Vecellio, known as Titian, who is the author of *The Concert* in the Pitti Palace, formerly credited to Giorgione.

In Titian's long career (he was born about 1480 and died in 1576), there was a period in which he painted somewhat like Giorgione (*The Concert*, Prado *Madonna*), which ended with the frescoes *Miracles of St. Anthony of Padua* in the Scuola del Santo of Padua (1511). After this his forms were enlarged, his luminous colors spread out over wide areas, and he created images of Olympian beauty: *Sacred and Profane Love* (Borghese Gallery), *Flora* (Uffizi Gallery), the series of pictures painted for Alfonso d'Este, the *Bacchanals* of the Prado, the portraits *Alfonso d'Este* and *Laura Dianti* (Louvre), and a series of sacred conversation groups. In the Frari *Assumption of the Virgin* (1518), there appeared a new rush of movement, which was characteristic of the next 20 years: *Bacchus and Ariadne* in the National Gallery of London, the altarpiece *Resurrection of Santi Nazzaro e Celso* at Brescia (dated 1522), the *Madonna Pesaro* altarpiece at the Frari, the *Deposition* now at the Louvre, and others.

Titian's fame was immense, and after the dukes of Ferrara his patrons included the dukes of Mantova; Emperor Charles V, of whom he did some famous portraits; the dukes of Urbino (the *Venus of Urbino*, the portrait of *Francesco Maria della Rovere*, duke of Urbino, now in the Uffizi Gallery, and *La Bella* in the Pitti Palace); Francis I; Pope Paul III (portraits in the Naples Gallery); and Philip II of Spain. His style

continued to develop, characterized by a remarkable quality of painting and a gift for psychological interpretation most evident in his portraits. In the years 1535–1550 his compositions revealed a plastic element undoubtedly inspired by Michelangelo. This phase was followed by an increasingly immaterial vision of life. His human figures were enveloped and almost absorbed by a dense atmosphere, and the play of light and shadow made for fantastic transmutations in which they seemed to be only concrete embodiments of the surrounding air. From this final period date the *Martyrdom of St. Lawrence*, the *Annunciation* in San Salvatore, Venice, and the unfinished *Pietà* of the Venice Academy.

All the Venetian painters of Titian's time were drawn into his orbit: Jacopo Palma, called Palma Vecchio, or Il Vecchio (1480?–1528), who did the *St. Barbara Between St. Anthony and St. Sebastian* in Santa Maria Formosa, (Venice); Giovanni Antonio da Pordenone (real name Giovanni Antonio de' Sacchi, 1483–1539); Bonifazio Veronese or Veneziano (properly Bonifazio dei Pitati, 1487–1553); Paris Bordone (1500–1571); and others.

Lorenzo Lotto (c.1480–c.1556) had a restless and imaginative spirit, and great originality, as well as a sense of form less regular and humanistic than that of Titian, and a more incisive use of light. He went from Venice to Marche and then to Rome (1509–1512); to Bergamo (1513–1527), where he influenced the local school of painting and that of Brescia, represented by Giovanni Girolamo Savoldo (c.1480–c.1548), Il Romanino (real name Girolamo Romani, 1485–1566), and Il Moretto (real name Alessandro Bonvicino or Buonvicino, 1498–1554); and to Loreto, where he died. He was receptive to every influence—Raphael, the German and Lombard schools—and although he sometimes appears rudderless, he maintains a uniformly high level. Among his works are the *St. Jerome* in the Louvre (1500); the altarpiece of Santa Cristina, Treviso, and those of Asolo (1506), Recanati (1508), and Bergamo—San Bartolommeo in 1516, and San Bernardino and Santo Spirito in 1521—the frescoes at Trescorre; the altarpieces of the Carmine (1529), and of Santi Giovanni e Paolo (1542) in Venice, and those at Jesi, Cingoli, and Macerata; many fine portraits and smaller pictures; and his last work at Loreto, which has the beauty of the older Titian with an added note of intimate trepidation.

Il Tintoretto (real name Jacopo Robusti, 1518–1594) marks the beginning of a more spectacular type of painting. He matured at the time when Titian was laboring under the spell of Michelangelo and adopted mannerist forms, which were transfigured by fantastic effects of light and shadow, which grew more and more accentuated. Tintoretto's compositions are full of motion and drama, painted with a rapid touch, with strong light effects standing out against shadow. His production was enormous. It consisted mostly of sets of large pictures such as those of the Scuola di San Marco, now divided between the Venice Academy and the Brera Gallery, including the *Miracle of St. Mark* (which first brought him fame in 1548), the *Transportation of the Body of St. Mark*, and *St. Mark Rescuing a Shipwrecked Saracen*; and the immense cycle of mural paintings of the Scuola di San Rocco, on which he worked at three different periods be-

tween 1560 and 1587. Other works are the canvases in Santa Maria dell' Orto (*Presentation of the Virgin in the Temple*), the Ducal Palace (*Marriage of Bacchus and Ariadne and Paradise*), and San Giorgio Maggiore (*Last Supper*).

Paolo Veronese (real name Paolo Cagliari or Calari, 1528–1588) painted in a very different style. After studying with Antonio Badile (1518–1560) in Verona, he was attracted to Michele Sanmicheli, who gave him a classical grandiosity, and came to Venice with a style all his own and a range of deep, bright colors set against the light and carried over into large and serene forms, together with a remarkable sense of intervals and harmony. The Venetian tendency was to melt colors into one another and make shadow predominant, whereas Veronese lightened the shadows, played on contrasting colors, and created a world more luminous than that of reality, suffused with an atmosphere of joy and festivity. He, too, painted large pictures and decorative cycles: ceilings of the council room and the college of the Ducal Palace (*Venice Enthroned*), from 1572 to 1575; the ceilings, altarpieces, and frescoes of San Sebastiano, Venice; the frescoes of the Villa Barbaro at Masèr; and a series of biblical banquets now in the Turin Gallery, the Louvre (*Christ at Emmaus*), and the Venice Academy, besides many other altarpieces, portraits, and mythological compositions.

Jacopo, or Giacomo, da Bassano (originally Ponte, 1510–1592) was closer to Tintoretto than to Veronese. Though living in the atmosphere of 16th century humanism, he preferred to depict peasants, animals, and market places, and is sometimes called the forerunner of genre painting.

16th Century Architecture.—*Rome.*—The transition from 15th to 16th century architecture is typified by Bramante (real name Donato d'Angnolo or d'Angelo, 1444–1514). About the years 1477–1479, at about the same time as Leonardo, Bramante was active in Lombardy: Santa Maria presso San Satiro and the apse and doorway of Santa Maria delle Grazie, both of which are in Milan. In 1499, he transferred his activities to Rome, where the circular temple (Il Tempietto) of San Pietro in Montorio and the cloisters of Santa Maria della Pace led up to his major works: the court of the Belvedere in the Vatican and the project for rebuilding St. Peter's with a central plan and a dome. A grandiose conception of space and a strengthening of the architectural masses in such a way as to intensify the effects of light and shadow and chiaroscuro are characteristics of his style, which inspired all those who followed him, including his successors at St. Peter's: Fra Giovanni Giocondo (1433–1515); Giuliano da Sangallo (originally Giuliano Giamberti, 1445–1516); Raphael, whose genius for painting has overshadowed his harmonious achievements in building; Baldassare Peruzzi of Siena (1481–1536), close to Raphael and designer of the Villa Farnesina; and, greatest of all, Antonio da Sangallo il Giovane (originally Antonio Cordiani, 1483?–1546), who during the pontificates of Leo X (r. 1513–1521), Adrian VI (r. 1522–1523), Clement VII (r. 1523–1534), and Paul III (r. 1534–1549) dominated the Roman scene, with his work at St. Peter's and the Farnese Palace in Rome, and military constructions at Orvieto, Civitavecchia, and Perugia (this last, a citadel demolished in 1860).

Antonio da Sangallo was for a long time a rival of Michelangelo, who was turning more and

more to architecture. The latter's first assignments were given to him by Leo X and Clement VII in Florence—the façade of San Lorenzo (which he never carried out), the Laurentian Library and the new sacristy (Medici Chapel) in San Lorenzo, with the tombs of Giuliano and Lorenzo de' Medici, ornamented with the famous statues, *Day* and *Night*, *Twilight* and *Dawn*. The model for the chapel was Brunelleschi, but we can see that a powerful breath of something new has blown through his designs: the space seems more grandiose, and the framework more robust, the pediments are broken, and niches are placed where Brunelleschi had planned flat surfaces.

Michelangelo continued to work after his return to Rome, with no less fire but with still more grandiose movement. He had more to do after the death of Antonio da Sangallo, whom he succeeded at the Farnese Palace (cornice and central window) and at the architectural workshop of St. Peter's, which he directed from 1547 until his death. He changed Sangallo's plan to one "of lesser size but greater majesty," and built both the apse and dome. In 1546 he began to draw up a project for the arrangement of the Piazza del Campidoglio (Capitoline Place); under Julius III (r. 1550–1555), he worked on San Pietro in Montorio and San Giovanni dei Fiorentini; while under Pius IV (r. 1559–1565), he supplied plans for the Porta Pia (1561) and transformed the Baths of Diocletian into the Church of Santa Maria degli Angeli (1561–1563). While most of his efforts were devoted to bringing about revolutionary changes in building methods, the old Michelangelo went off by himself to sculpture and because his thoughts turned continually to death he did three *Pietà*, one for his own tomb, which is in Florence Cathedral, the Palestrina *Pietà* now in the Strozzi Palace of Florence, and the *Pietà* now in the courtyard of the Rondanini Palace in Rome. Each has outlines more worn out than the last, and their unfinished quality is the most perfect expression of a vision more and more immaterial.

Architecture continued to develop vigorously in Rome after Michelangelo's death. Architects thronged to the city from all over, and particularly from northern Italy, bringing with them tastes and training alien to the Florentine tradition and, in general, a trend toward more irregular and ornate forms. Giacomo da Vignola (real name Giacomo or Barozzi, 1507–1573) stands out above the rest of these architects. He was Michelangelo's successor at St. Peter's, and with the Villa Farnese at Caprarola, and Il Gesù, or the Church of the Jesuits, in Rome, which he was commissioned to do in 1568, he created types which were to serve as models to all his successors. Vignola's most immediate follower was Giacomo della Porta (1541–1604), who did the façade of Il Gesù. Another important architect of late 16th century Rome, in the footsteps of Michelangelo and Vignola, was Domenico Fontana (1543–1607) who came from Lago di Como and worked on St. Peter's under Pope Sixtus V (r. 1585–1590).

Venice.—In architecture as in painting, the other pole of Italian art at this period was Venice and its vicinity. The chief architects were Jacopo Sansovino, Michele Sanmicheli, and Andrea Palladio.

Jacopo Sansovino (real name Jacopo Tatti, 1486–1570) was educated in Florence and Rome,

but only in Venice, where he settled after 1527, did he create a style of his own, in which he brilliantly combined the monumental grandeur of structure characteristic of central Italy with the animated and airy pictorial effects of the north. The arcades and large windows of his buildings provide a background of shadow against which the well-modeled framework is projected into the light. Among his works are the old library of St. Mark, the *Zecca* (mint), the Scuola della Misericordia, and the Cornaro Palace. Sansovino brought Tuscan Renaissance forms to Venice and fused them with the dominant features of local architecture.

Michele Sanmicheli (1484-1559) of Verona was trained at Rome in the Bramante tradition and served as an assistant to Antonio da Sangallo in the latter's military constructions. After the sack of Rome in 1527, Sanmicheli returned to the north and worked at Venice, Verona, and other inland cities. His style is more massive and robust than that of Sansovino, but also his constructions blend together monumental structure with intense effects of light and shadow, obtained by deep openings and the alternation of recesses and projections in the body of his buildings, among them the Malfatti and Bevilacqua palaces, the Porta Nuova, and Porta Pallio at Verona, and the Grimaldi Palace at Venice.

Andrea Palladio of Vicenza (1508-1580) has always been considered the most classical of 16th century Italian architects. Modern critics stress the fact that his feeling for wide space is allied to contrasts of shading, which are accentuated by the antithesis between stretches of solid wall and deep doorways, together with luminous colonnades standing out against an empty background. Palladio left a vast number of works behind him, reflective of a wealth of ideas and highly original architectural devices: the Basilica (damaged in World War II) and Loggia del Capitano, the Chiericati and Valmarana (partly destroyed) palaces, and the Teatro Olimpico at Vicenza; San Giorgio Maggiore and the Church of Il Redentore at Venice; and a series of wonderful country houses in the surrounding region—Villa Godi-Porto at Lonedo, Villa Barbaro at Masèr, Villa Foscari at Malcontenta, and Villa Rotonda or Capra near Vicenza. Palladio's followers—the closest among them was Vincenzo Scamozzi (1552-1616)—interpreted his style in a cold, academic, and colorless manner. This was even more true of the neoclassical architects who throughout Europe took him as a model.

Florence.—The monumental architecture of 16th century Florence took on a more severe character. Giorgio Vasari (1511-1574) of Arezzo, who shone as an architect rather than a painter, built the Uffizi Palace in Florence, the headquarters of the Order of St. Stephen at Pisa, and the Loggia at Arezzo. Bartolommeo Ammanati (1511-1592), who was also a sculptor, designed the handsome Santa Trinita Bridge in Florence, which was unfortunately destroyed during World War II, and Bernardo Buontalenti (1530-1608), the Casino Mediceo. In Milan and Genoa, Pellegrino Tibaldi (1527-1596) and Galeazzo Alessi (1512-1572), both very active, obtained pictorial effects in their styles.

16th Century Sculpture.—Some of the great architects whom we have mentioned above were, like Michelangelo, first-rate sculptors as well.

Jacopo Sansovino adapted the refined plastic forms of the prevailing Florentine style to softer and more pictorial effects in both fields. The *Bacchus* in the Bargello is one of his youthful accomplishments, but he is better represented by his Venetian works: the *Madonna dell' Arsenale*, the statues of the loggia of the Campanile, the bas-reliefs of the bronze door leading to the sacristy of St. Mark's. Under his influence, the Venetian sculptors used animated surface movements subject to the play of light and shadow. The greatest of them, Alessandro Vittoria (1524-1608), did remarkable portrait busts fashioned with a quick, easy touch.

In 16th century Florence all the sculptors imitated Michelangelo, but with varying shades of interpretation. Baccio or Bartolommeo Bandinelli (1493-1560), who did the monument to Giovanni de' Medici (Giovanni dalle Bande Nere), copied him in a smooth but coldly academic style, while Bartolommeo Ammanati and Benvenuto Cellini (1500-1571) adapted his mannerist side to decorative purposes and drew from it greater flexibility of form and elegance of rhythm. Ammanati's masterpiece is the Fountain of Neptune in the Piazza della Signoria, and Cellini's the *Perseus* in the Loggia dei Lanzi. Cellini was also famous as a goldsmith and worked for a long time in France. Il Tribolo (Niccolò di Raffaello de' Pericoli, 1500-1550) revealed a vein of fresh rustic poetry in the fountains of Petraia and Castello.

In Lombardy, Giovanni Antonio Amadeo was a leading sculptor as well as an architect. After the activity of Gian Cristoforo Romano (1470-1512), Cristoforo Solari or Solario, known as Il Gobbo (1450?-1527), Benedetto Briosco, Agostino Busti, known as Il Bambaja (1483-1548), and the many other comparatively little-known sculptors who did the mass of statues in the Cathedral of Milan, Leone Leoni, known as Il Cavaliere Areolino (1509-1590), suddenly introduced into Lombardy the mannerist style (tomb of the marquis of Marignano in the cathedral). In Rome, on the other hand, a Lombard, Fra Guglielmo della Porta (died in 1577), with his tomb of Pope Paul III in the choir of St. Peter's introduced into the mannerist Roman style an accent of greater truth and directness and a robust plasticity. This was one of the ways in which the 16th century moved toward the baroque. Another move in the same direction can be seen in the work of Jean Boulogne, who was known as Giambologna (1529?-1608), a sculptor from Douai who came to Italy around 1551 and settled first in Rome and then in Florence. After studying the work of Ammanati, Tribolo, and Cellini, he created an increasingly complex type of composition, where the figures are in elaborate counterposition, presenting their surfaces in the round and requiring the spectator to look at them not from one but from many points of view. This process was a development of the serpentine line enunciated by Giovanni Lomazzo. Giambologna's most famous works are the *Neptune* in the principal fountain of Bologna, the *Rape of the Sabines* in the Loggia dei Lanzi in Florence, the *Hope* of the University of Genoa, numerous small bronzes such as the *Apollo* in the small study of the Palazzo Vecchio, the *Mercury* and *Bathing Venus* of the Bargello, the *Apennine Fountain* at Pratolino, and the *Venus* in a grotto of the Boboli Gardens.

17TH AND 18TH CENTURY ART

The chief elements of the baroque period of Italian art (which characterized the 17th century, and a good part of the 18th century before being superseded by the rococo and the neo-classical styles) are the Accademia degli Incamminati of the Carracci family at Bologna; the architectonic creations of Giovanni Lorenzo Bernini and Francesco Borromini in Rome, along with the architectural works that accompanied them; Caravaggio; the development of the Roman style into Piedmontese baroque, which was really due to Guarino Guarini of Modena and the Sicilian Filippo Iuvara, both of whom were trained in Rome; Bernini's sculpture; and the formation of an international school of art in Rome, where artists came to study and work from all parts of Europe.

Painting.—The Carracci or Caracci—Lodovico (1555–1619), Agostino (1557–1602), and Annibale (1560–1609)—founded an academy for the purpose of combating the caprices and exaggerations of the mannerists. They preached the study of the 16th century masters and held that a combination of the best features of each one—the plastic quality of Michelangelo, the chiaroscuro of Leonardo and Correggio, and the color of Titian—would produce an ideal eclectic style. For this theoretical aberration modern critics have unmercifully condemned them. In reality, among a host of merely clever and calculated academic compositions, they succeeded in some of their best works, especially those of Lodovico and Annibale, in attaining a mixture of realism and allusive feeling that was a new contribution to the art of the time and brought them a following throughout the continent. Such works include the *Annunciation*, *Madonna and Saints*, *Madonna of the Rosary*, and *Madonna degli Scalzi*, all in the Bologna Gallery, by Lodovico; and the *Baptism of Christ* in San Gregorio, Bologna, landscapes in the Doria Gallery, and frescoes of the Farnese Palace, Rome, by Annibale.

A host of painters flourished in the wake of the Carracci at Bologna. Outstanding among them was Guido Reni (1575–1642), who like most members of the school worked chiefly in Rome, painting an enormous number of portraits, altarpieces, and mythological compositions: *Atalanta* (Naples Gallery); *Aurora or Triumph of Phoebus* (Casino Rospigliosi), *Concert of Angels* (San Gregorio Magno, Rome). Among other followers of the Carracci, we may mention Francesco Albani or Albano (1578–1660) and Il Domenichino (real name Domenico Zampieri, 1581–1641).

Michelangelo da Caravaggio (real name Michelangelo Merisi, or Merisio, 1577–1610) rebelled against this exceedingly cultured circle. Coming to Rome from his native Lombardy around 1585, he soon found himself in open personal and artistic conflict with the painters of the day: hence a series of quarrels, prison sentences, and escapes, and creation of a kind of painting directly opposed to both mannerism and the eclecticism of the Carracci school. Caravaggio turned his back on tradition and effected a great simplification. He treated sacred themes in a manner which his contemporaries branded as brutally realistic, stripping them of their conventional idealization and interpreting them as scenes of everyday life, peopled by figures drawn from the lower classes. People were shocked to see him portray St. Matthew as a rough fisher-

man, with bare feet and widespread legs, and to take as a model for the Madonna on her deathbed a poor girl who had drowned in the Tiber. What Caravaggio was really doing was to refresh his spirit with elemental truths, which he then presented in a powerful and compelling manner. He painted not only human figures but also objects (his *Fruit Basket* in the Ambrosian Library of Milan is the first Italian still life) emerging from a shadowy background, in all their bodily solidity, giving them the illusion of reality without excessive detail so that they stand out like glimpses of nature struck by a ray of light. His was a naturalism that was not rational, but he had a feeling for direct lighting which he drew from the tradition of Lombardy, where all the great masters from Foppa to the school of Brescia (Lorenzo Lotto and Giovanni Girolamo Savoldo) had worked along the same line.

After a series of half figures with still lifes, the *Magdalen* and *Flight into Egypt* of the Doria Gallery, Caravaggio's first monumental work was the St. Matthew cycle in San Luigi dei Francesi (French Church of St. Louis) in Rome. There followed the *Virgin and Pilgrims* in Sant' Agostino (1597), the *Fall of St. Paul* and *Crucifixion of St. Peter* in Santa Maria del Popolo (1600–1601), the *Entombment of Christ* in the Vatican Gallery (1602), the *Death of Mary* in the Louvre (1605–1606), and the *Madonna dei Palafrenieri* in the Borghese Gallery. In 1607, Caravaggio fled from Rome to Naples, where he executed the *Madonna of the Rosary*, now in Vienna, and the paintings in the Church of the Misericordia; thence to Malta (1608), where he did work for the church of La Valletta and the portrait of Alof di Vignacourt (*Grand Master of the Knights of Malta*) now in the Louvre; and finally to Sicily (*Burial of St. Lucy* at Siracusa and *Nativities* at Palermo and Messina). He died a fugitive on the beach of Porto Ercole.

Caravaggio's revolutionary, antiacademic, and luminous vision influenced all of European art from the Flemish school to Diego Velázquez. He had many followers in Rome, among them Orazio Gentileschi (1563–1647), a Tuscan who was greatly influenced by the style of the youthful work of Caravaggio, migrating from Rome to Marche, and then to Genoa, Turin, Paris, and London; Carlo Saraceni (1585–1625); Bartolomeo Manfredi (1572–1605); the Roman Orazio Borgianni (1578–1616); the French Jean de Boulogne, known as Le Valentin (1600–1634); and a group of Flemings that included Gerard van Honthorst. In Italy, he chiefly influenced the 17th century Neapolitan school: Battista Caracciolo, known as Battistello (c.1570–1637); José or Giuseppe Ribera, known as Lo Spagnoletto (1588–1652), Mattia Preti, known as Il Cavaliere Calabrese or Il Calabrese (1613–1699), and Bernardo Cavallino (1622–1654). But his influence extended also to Genoa, Lombardy (Antonio d'Enrico, known as Tanzio da Varallo, c.1574–1644), and even to Bologna, still the domain of the Carracci (Guido Reni, sporadically, and, more, Guercino, real name Giovanni Francesco Barbieri, 1591–1666).

The Carracci school inspired the lively group of baroque decorators who, as the 17th century progressed, complicated their compositions with more and more illusory and scenic effects and intensified the restlessness of their movement. Among them were Pietro da Cortona (originally Pietro Berrettini, 1596–1669); Il Baciccio (real

name Giovanni Battista Gaulli, 1639–1709) of Genoa (the frescoes in the church *Il Gesù*); and Andrea dal Pozzo (1642–1709) of Trento, who did the frescoes in Sant' Ignazio, Rome. In Naples the influence of both Carracci and Caravaggio was reflected in the numerous paintings of Luca Giordano (1632–1705), who worked all over Italy; Salvator Rosa, also called Salvatoriello (1615–1673); the still-life painters such as Giovanni Battista Ruoppolo (1620–1683); and, in the 18th century, in Francesco Solimena (1657–1743), Francesco de Mura (1696–1782), and Corrado Giaquinto (1699–1765). In Genoa the influence of Peter Paul Rubens and Sir Anthony Vandyke made itself felt alongside those of Caravaggio and the Roman baroque school, with the work of Orazio de' Ferrari (1605–1657) and his son Giovanni Andrea (d. 1657), Giocchino Assereto (1600–1649), Giovanni Andrea Ansaldi (1584–1638), Valerio Castello (1625–1659), Giovanni Benedetto Castiglione, called *Il Grechetto* (1616–1670), and Bernardo Strozzi, a Genoese (1581–1644). The 17th century Lombard school was close to that of Genoa, with an added vein of pathos and piety designed to appeal to the religious feelings of the beholder: Pier Francesco Mazzucchelli, known as *Il Morazzone* (1571–1626); Giovanni Battista Crespi, known as *Il Cerano* (1576–1633), and his nephew Daniele Crespi (c.1590–1630). In Venice, 17th century painting was dominated by outsiders: Domenico Fetti or *Feti* (1589–1624) from Rome, Giovanni Lys (c.1600–c.1630) from Oldenburg, and Bernardo Strozzi from Genoa. Francesco Maffei (c.1625–1660) of Vicenza was the only heir to the local 16th century tradition.

The line of 18th century baroque decorators culminated in Giovanni Battista Tiepolo (1696–1770). To find his origins we must go back to Sebastiano Ricci (1660–1734), who after the long period of stagnation that followed the death of the 16th century Venetian masters was the first to re-establish contact with the new movements in Italian art in which the Venetians had no part. He went to Bologna, Rome, Milan, and Florence and acquired a free, mobile style, with a facility for light and vivacious decoration. Another forerunner of Tiepolo was Giovanni Battista Piazzetta (1682–1754), who studied with Giuseppe Maria Crespi, known as *Lo Spagnuolo* (1665–1747), the most intelligent painter of his time at Bologna. Tiepolo also drew upon Paolo Veronese, whose range of colors was lighter and brighter than that of the baroque decorative school. He soon abandoned the theatrical elements of this school's ornamentation, reduced to a minimum the use of architectural framework, thinned out his masses, and launched his figures into luminous open skies. In his work the theatrical quality of the baroque is lighter and more imaginative, and its melodramatic accents give way to an airiness of tones that lends his composition genuine decorative value.

Tiepolo painted a number of altarpieces, but for the most part he decorated walls and ceilings—frescoes of the cathedral (1726) and bishop's palace at Udine; frescoes of the Colleoni Chapel at Bergamo and the Villa Valmarana near Vicenza (destroyed); Gesuati ceiling in Venice, Clerici (destroyed) and Dugnani palaces in Milan (all of these between 1730 and 1740); then the ceiling of the Scuola del Carmine (1740–1744) and the drawingroom of the Palazzo Labia in Venice (1757); the stairway of the partially

destroyed archbishop's palace of Würzburg (1751–1753); and the ceiling of the Scalzi at Venice (destroyed), until his late works in the royal palace of Madrid, where the artist went in 1763.

By this time there was a neoclassical reaction to the liberties and caprices of the 18th century. With Tiepolo we may say that the great Italian tradition came to a close. Eighteenth century Venice did, however, produce several landscape painters who were to attain fame abroad. Francesco Guardi (1712–1793) made fantastic transformations of landscape in a shifting atmosphere where architecture and figures alike lost all consistency. The two Canalettos—Antonio Canaletto (originally Canale or Canal, 1697–1768) and Bernardo Belotto or Bellotto (1720–1780), his nephew—painted their landscapes as views. Their conscientiously faithful interpretations are distinguished by a marvelous unity of tone and perspective. Antonio worked for some years in London, and Bernardo Canaletto at Dresden, Vienna, and Warsaw. Eighteenth century Venice dissolved in caprice and the melancholy of Francesco Guardi bore traces of the approach to landscape painting that marked the two Canalettos. So-called 18th century frivolity found a last interesting artistic expression in the pastel portraits of Rosalba Carriera (1675–1757), which were known over most of Europe, and the genre paintings of Pietro Longhi (originally Pietro Falca, 1702–1785).

Architecture and Sculpture.—Architecture and sculpture in the 17th and 18th centuries developed along the same lines as painting. Architecture began by breaking down the unified, enclosed spaces of the Renaissance, while keeping and indeed accentuating monumental mass effects and vigorous contrasts. Then gradually it grew lighter in weight and even in color, for with a decrease in the contrast between recesses and protuberances the shadows thrown on the body of the buildings were less deep and glided almost luminously over the vast extents of flat surface. The same thing was reflected in the delicate modeling of sculpture.

Giovanni Lorenzo Bernini (1598–1680) was the great artist who transformed the mannerist style into baroque. The multiple trends of 16th and 17th century Rome, all the attempts to achieve effects of motion and open, pictorial space, were blended by his genius into an integral new vision. Internally, the irregularity of his ground plans, the chapels and galleries which interrupt the peripheral walls, give an effect of illusory and indefinite space much greater than that of reality. And the outside of his buildings, too, broken by lively bas-reliefs, offers a new prospect with every change in the onlooker's point of view, drawing the surrounding space into the general artistic effect. Bernini's constructions cannot be detached from the places where they have been erected, for he designed them in such a way that they should be seen from a particular standpoint and among definite local atmospheric effects, including in the effect what already existed around the building. Typical is the grandiose colonnade of St. Peter's (1656–1663), which opens up like the two arms of an immense ellipse. The broad, low façade of the church, which was designed by Carlo Maderna or Maderno (1556–1629) and was bitterly criticized for destroying the effect of the dome, is cleverly incorporated into the colonnade, with its heavy

horizontal lines displayed to advantage above the pillars. Others architectural works of Bernini in Rome are the Barberini Palace, which he completed, and Sant' Andrea al Quirinale (1678).

Bernini worked with equal freedom in the field of sculpture. Here, too, we have no cohesion of plastic masses, but a central force that projects the shape of the figures into space, accompanied by a continuous vibration of light and shadow. As the surrounding space is drawn into the architectonic effect, so the figures direct their gestures and motions into the air around them and belong in a compellingly natural manner to the real world. The first work that bears witness to these qualities is the *David* (1619) of the Borghese Gallery; then come the *Apollo and Daphne* and the *Rape of Proserpine* in the same place, the *Santa Bibiana* in the church of the same name (1626), the *San Longino* in St. Peter's (1638), the famous *St. Teresa* in Santa Maria della Vittoria (1644), the *Beata Lonovica Albertoni* in the Church of San Francesco at Ripa, and the tombs of popes Urban VIII (1647) and Alexander VII in St. Peter's, not far from his bronze altar canopy and *cathedra Petri*, or throne of St. Peter. There are also a number of splendid portrait busts (*Cardinal Scipione Borghese*, *Francis I d'Este*, *Costanza Bonarelli*) and fountains (the Four Rivers in Piazza Navona and the Triton in Piazza Barberini).

Bernini's production was enormous. He held a position of supreme prominence in the papal court, and his fame spread throughout Europe. Only two of his Roman contemporaries can be mentioned in the same breath: the architect Francesco Borromini and the sculptor Alessandro Algardi. Borromini (1599-1667), born in Canton Ticino, then Italian, was a very great and original artist, worthy of comparison to Bernini, whose glory overshadowed his except for a brief period of fame under Pope Innocent X (r. 1644-1655). His imagination was more sinuous, lighter, and more bizarre, and he made daring architectonic solutions: elliptic ground plans, undulating walls, interrupted entablatures, and towers that narrow into spires and pinnacles. He was imitated more in the later rococo period than in his own. His chief works are the churches of San Carlo alle Quattro Fontane, Sant' Agnese in Piazza Navona, Sant' Ivo alla Sapienza, the Collegio di Propaganda Fide, and the Filippini Oratory. Other important Roman architects of the 17th century were Pietro da Cortona (more sober in architecture than in painting), Carlo Rainaldi (1611-1691) and Carlo Fontana (1634-1714).

Outside of Rome, in Florence, which was still closely bound to the Renaissance tradition, and in Venice, the baroque style never acquired deep roots. One talented piece of work in Venice dating from this period is the church of Santa Maria della Salute by Baldassare Longhena (1604-1682), who also built the Pesaro Palace, The city of Turin, which had no architecture worthy of mention during the Renaissance, acquired one of considerable importance in the 17th and 18th centuries through the work of Guarino Guarini and Filippo Juvara.

Guarino Guarini (1624-1683) brought to Turin a complex style formed by the influence of Borromini in Rome and travels in Emilia, Sicily, and France. He showed himself a daring builder in the high domes of Santissima Sindone and

San Lorenzo, where he topped the churches below with a system of ribs and slender intersecting arches, functionally essential but possessing at the same time a decorative value of lines and perforations. His chief other works are the church of La Beata Vergina della Consolata, and the Carignano Palace and the Academy of Sciences, with their handsome brick walls. Guarini gave new architectural ideas not only to Piedmont but to the rest of Italy as well, and his work marked the transition from baroque to rococo.

Guarini's work was continued on an even greater scale by Filippo Juvara or Juvara (1676?-1736), who had also studied in Rome. His style was more luminous, harmonious, and serene, and the buildings he left behind him are familiar landmarks in the modern city of Turin: the new façade and the double staircase of the Madama Palace, the splendid Basilica of Superga on top of the hill of that name, the church of the Castle of Venaria and the Church of the Carmine in the city (both of these last damaged during World War II), the façade of Santa Cristina, and the grandiose hunting lodge at Stupinigi, with wings radiating out of a central body. He also worked outside Italy, building the royal palace in Lisbon and drawing up plans for that in Madrid, which was actually constructed by Giovanni Battista Sacchetti, his pupil.

Luigi Vanvitelli (1700-1773) was connected in his beginnings with Juvara, and accomplished much work of similar style and equal importance at the court of the Neapolitan Bourbons. His greatest single building is the royal palace at Caserta, a sort of Italian Versailles, with wonderful perspectives of gardens and fountains. Notable 18th century architects in Rome included Alessandro Galilei (1691-1737) and Ferdinando Fuga (1699-1780). After this time the greatest Italian architects went to work abroad. Francesco (or Bartolomeo) Rastrelli (1700-1771) built the Winter Palace and the Peterhof in Leningrad, and the palace at Detskoe (Tsarskoe) Selo, preceding Jacomo Quarenghi (1744-1817), who worked for many years at the court of Catherine II and was followed in his turn by Carlo Rossi (1775-1849).

Although Bernini's sculpture exercised a wide influence in the 17th century, its essential values were not properly understood even by his collaborators. He had as a rival in papal favor the architect-sculptor, Alessandro Algardi (1602-1654) of Bologna, who was in favor during a brief eclipse suffered by Bernini under the pontificate of Innocent X. He opposed to Bernini's animated and pictorial style a sterner and more static concept, which is expressed not so much in an academic work such as the marble altarpiece depicting the *Retreat of Attila from Rome* in St. Peter's as in his smaller figures and portrait busts, where he made strong characterizations: statue of *Innocent X* on the Campidoglio, bust of *Donna Olimpia Pamphili* in the Doria Gallery.

Other notable 17th century sculptors in Rome were François Duquesnoy, known as François Flaman (1594-1643), and Francesco Mochi (1580-1654), a native of Montevarchi, who first studied in Florence and carved the fine equestrian statues of Alessandro and Ranuccio Farnese in Piacenza. At the turn of the century we find the Lombard Camillo Rusconi (1658-1728); the Italianized Frenchman

Pierre Legros (1666–1718); the Roman Pietro Bracci (1700–1773), perhaps the freest and most vivacious of all, who directed the decoration of the Trevi Fountain; and Filippo della Valle (1697–1768), a Florentine whose work had clear, almost academic outlines. After him art passed over into the neoclassical style. Outside Rome, we must recall Gian Maria Morlaiter (1699–1781) of Venice, who left roughed-out pieces in the Correr Museum and also worked in Saxony and Russia, and Giacomo Serpotta (1656–1732) of Palermo, an original worker in plaster, who produced partitions, garlands, draperies, feminine figures, and *Putti* applied to the decoration of the oratory of San Lorenzo and the churches of Santa Cita and the Rosario.

International Influences.—In the course of the 17th and 18th centuries, Rome became a center of attraction for all Europe. As early as the 16th century Italian artists had worked in other countries. Leonardo died in France. Andrea del Sarto went there in 1518, followed by Sebastiano Serlio (1475–1554), Francesco Primaticcio (Le Primatice, 1504–1570), Niccolò dell' Abbate (also Abate or Abati, 1512?–1571), Il Rosso, and Benvenuto Cellini. Such were, indeed, the origins of the school of Fontainebleau. Titian worked for Francis I, Charles V, and Philip II, and Leone Leoni and his son Pompeo (d. 1608) were active for a long time in Spain. In the 17th and 18th centuries, we recall that Tiepolo died in Spain, the Canalettos worked in England, Saxony and Poland, and various architects and portrait painters were scattered about the courts of Europe.

An opposite movement also developed in the 16th century and grew in the two centuries that followed—namely, the migration to Italy of foreign artists, attracted by the flowering of the Renaissance. First came the Flemings of Rome, then Rubens, Vandyke, the Dutch followers of Caravaggio, and finally the French: Le Valentin, Simon Vouet, Nicolas Poussin, Claude Lorrain, and the rest. It became the custom for artists of every country to make a trip to Italy, and more particularly to Rome, the seat of many academies and a truly international center. There came a time when the leading artists and critics of Rome were none of them Italian. This fact was most apparent during the neoclassical movement, which had scholarly and archaeological origins, contemporaneous with the excavations of Herculaneum, Pompeii, the Palatine Hill, and Hadrian's villa at Tivoli. Little by little, archaeological interest developed into an aesthetic theory, and the brilliant light touch of the 18th century was judged to be frivolous in comparison with a revived ideal of classical grandeur and severity. Two Germans living in Rome, Johann Joachim Winckelmann (1717–1768) and Anton Raphael Mengs (1728–1779), established the canons of the new theory.

Among the Italian neoclassical artists only one, Antonio Canova (1757–1822), won European fame. Canova was trained in Venice, and his early works reflected the grace of the 18th century (*Apollo* and *Daedalus* and *Icarus* in the Venice Academy). Coming in 1779 to Rome, he executed the monuments to Pope Clement XIII in St. Peter's and Clement XIV in the Santi Apostoli, in which his style was abstract and academic, displaying great virtuosity of detail. His fame grew, and his sculptures of members of the Bonaparte family—the famous *Pauline*

(*Venus Borghese*) in the Borghese Gallery, Napoleon's mother, and Napoleon himself—his *Venus* in the Pitti Palace, and his *Hebe Pouring Nectar* (Berlin), and *Cupid and Psyche* (Louvre), together with many highly stylized busts, were generally considered to be perfect expressions of the taste of the times.

An active neoclassic artistic center grew up in Milan. Here we find Andrea Appiani (1754–1817), inheritor of some 18th century qualities, more praiseworthy for his portraits than for his official panegyrics of Napoleon (frescoes of the Royal Palace of Milan, which were completely ruined in World War II); and the architects Giuseppe Piermarini (1734–1808), a well-balanced pupil of Vanvitelli, builder of the façade of the Belgioioso Palace and La Scala Theater; Leopoldo Pollack (1751–1806); Simone Cantoni (1736–1818), and Marchese Luigi Cagnola (1762–1833), all of whom endowed the city with a distinguished and coherent architectural style. In general, however, Italian art was becoming provincial—the real center was now elsewhere. This condition held true throughout the 19th century.

19TH AND 20TH CENTURIES

Art of the 19th Century.—Italy had its romantic trend, but it made very little impression upon the academic style. Francesco Hayez (1791–1882), who taught at the Brera Academy of Milan, substituted medieval themes for those of classical antiquity, while the so-called Nazarenes in Rome and the purist groups of Rome and Florence substituted religious themes and looked to painters before Raphael rather than to either classical or Renaissance art but remained essentially academic and did not create a new style.

After 1850 groups in several Italian cities tried to combat the prevailing academic trend. Domenico Morelli (1826–1901), Filippo Palizzi (1818–1899), and Gioacchino Toma (1836–1891) worked in this direction in Naples; Federico Faruffini (1831–1869) and the *scapigliati* (wild-haired ones), including Tranquillo Cremona (1837–1878) and Daniele Ranzoni (1843–1889), in Milan; and above all, the groups called the *macchiaioli*, in Florence: Giovanni Fattori (1825–1908), Silvestro Lega (1826–1895), Telemaco Signorini (1835–1901), Vito d'Ancona (1825–1884), Odoardo Borrani (1834–1905), and Adriano Cecioni (1836–1886), the sculptor. Giovanni Boldini (1845–1931) went to Paris and became a fashionable portrait painter. Giuseppe de Nittis (1846–1884) was another who won fame in Paris. Worthy of note were the Piedmontese artists Antonio Fontanesi (1818–1882), Enrico Reyceud (1855–1928), and Lorenzo Delleani (1840–1908).

For the most part 19th century sculpture was insignificant, but Medardo Rosso (1858–1927), originally one of the *scapigliati* of Milan, was a sensible artist. His heads of laughing women and sick children reach the extreme limit of plastic disintegration, and the extremely light touch of his modeling pulverizes the light over his sculptured surfaces.

If the activity in building was uncommonly great during all the 19th century, architecture, in the chaotic imitation of all manners of styles, never reached so low a level of incoherence as then.

20th Century Trends.—In the 20th century, a new culture gradually formed in art, based on greater consciousness of the real problems of

artistic form and vision. One painter, Amedeo Modigliani (1884–1920), who worked entirely in Paris, stands by himself. The futurist movement (1910–1914) was noisily pugnacious but exercised a rousing influence on Italian art. Many of the most intelligent artists were futurists, at least for a time: Umberto Boccioni, (1882–1916), the painter, and Antonio Sant'Elia (1888–1916), the architect, both of whom died in World War I, as well as Carlo Carrà (1881–), who did not remain long in the movement but was stimulated by it to define his style more rigorously. Carrà, along with Giorgio de Chirico (1888–), had a later surrealist period, in which he lost his dogmatism and became one of the leaders of 20th century Italian art. De Chirico went farther in the surrealist direction, and his evocative themes made him well known in Paris and other foreign cities.

Among other Italian painters, two are especially worthy of note—Giorgio Morandi (1890–1964), and Filippo de Pisis (1896–1956). Morandi is from Bologna, a painter of landscapes and still lifes with a thoroughly thought-out sobriety of style. De Pisis, who lived for many years in Paris, was involved in the last phase of impressionism, and showed some surrealist traces. A talented and productive painter, he calls up with a light touch and precision and beauty of tone the fleeting aspects of life around him. The best modern sculptors are the late Arturo Martini (1889–1947); Marino Marini (1901–), whose style is more stylized and archaic; and Giacomo Manzù (1908–), who expresses psychological values with greater emotion. There is general admiration among young artists for Pablo Picasso, and abstract art is the subject of furious debate.

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7. MUSIC. The genesis of Italian music is in the language of Italy itself. Before the middle of the 13th century, the founding of the Ital-

ian *dolce stil nuovo* (sweet new style), and, later, the work of Dante Alighieri (1265-1321), the language of the literature of Italy had been Latin, quasi-Provençal, and French. The Latin literature of the Middle Ages began about the 7th century. It contained chronicles and hymns, such as the *Dies Irae* (later incorporated in the service of the Roman Catholic Church) and the *Veni Sancte Spiritus*. It included poems, often satirical, and treatises on natural history and theology, together with religious and secular legends, both old and new. This Latin, however, was not the tongue of classical purity, for after the coming of the northern invaders in the 5th and 6th centuries, the language, even as used in writing, lost its ancient character, while in verbal use it altered constantly until it evolved into the various dialects of the land. These dialects possessed simple grammatical structure as a common characteristic, though in vocabulary some remained nearer to their source than others. (See also sections on *Language and Literature*.)

The oldest musical examples set to Italian texts are to be found in the *laudi spirituali*, or sacred songs, many of which are preserved in a manuscript in the Magliabechiana Library of Florence. The composers, known as *laudisti*, were found principally among Franciscan monks, the most famous of whom was Jacopone da Todi (c. 1230-1306). The *laudi* represent an extension of the ecclesiastical spirit into the vernacular.

Early *laudi spirituali* were monodic in character, and were sung by fraternities of penitents who practiced flagellation as a means of atonement. In traveling from place to place, they were met by local religious groups who joined in the singing of these sacred folk songs. The penitential practice spread into Germany, where the participants were known as *Geissler* (flagellants). The movement reached its height about 1348-1349, during the Black Death. The melodic schemata of the *Geisslerlied* anticipated the Lutheran chorale, which played such an important part in the work of Johann Sebastian Bach. Papal disapproval hastened the end of this movement, especially in Italy, although bands of *laudisti* remained until the 16th century and exerted an influence upon Palestrina and the oratorio form.

The *laudi* belong to the genre of folk creation closely allied to the *ballata*—the Italian equivalent of the French *virelai* (virelay), with its *ripresa* (refrain), stanza (a middle section), and a repetition of the *ripresa*. The *ballata*, of which the popular *Donna Lombarda* is a favorite of the Piedmontese, was originally a song sung while dancing, and is not unlike the English ballad. Other species of popular *canzoni* (songs) are the *zingaresca*, the *frottola*, the *stornello* and *rispetto* (both beloved of the Tuscans), the *mattinata*, sung at the break of day, and the *vicariola*, a type of song indigenous to Sicily and named after a prison in Palermo. The *stornello* is variously known as *ritondelle*, *ritornelle*, *ritornello*, *fiore*, or *fioretto*. Authorities differ as to its origin, but the accepted explanation is that it was derived from the practice of singing *storno*, that is, one singer singing against another antiphonally.

In examining the regional differences in folk song, we find that Sicily is considered to be the source and parent through which all poetry, both popular and cultivated, passed to the rest of

Italy. In the songs of the Piedmont, Liguria, Lombardy, and Venice, we find many legends, but none records such historical traditions as are to be found in those of Sicily. Tuscany, Umbria, Romagna, Marche, and even Calabria record little of the historical data found in the Sicilian ballads. The saga of that island is set forth in its lyrical folk literature. The Greek, Saracen, Norman, French, and Spanish occupations are all recorded in song. So, too, are the revolutions of 1820, 1848, and 1860, and the sanguinary revolt of 1866. Many of these songs have been transcribed for modern concert use by Geni Sadero (1891-).

In contrast to the Sicilian songs, the Tuscan folk airs are tempered by the kindness and gentleness of the northern disposition and invested with a quiet dignity and delicate charm. Some of these poetic fragments were translated by the German poet Paul Heyse, making them available for musical settings by Hugo Wolf. Central Italy focuses its attention on the Neapolitan *Piedigrotta*, a festival held yearly in honor of the Madonna in August and in which many songs receive their initial hearing. Such tunes as *Funiculi, funicula*, a modern song par excellence, written to celebrate the opening of the funicular railway up Mt. Vesuvius, *Torna a Sorrento*, *Addio a Napoli* (a favorite of Enrico Caruso, 1873-1921), and many others, find their way into the folk literature of the people, although strictly speaking they are not of the folk genre. It is interesting to note that the exceedingly popular tune *I zampognari* (*The Bagpipers*), a Christmas melody, was the source of George Frederick Handel's Pastoral Symphony and aria *He shall feed His flock* in *The Messiah*, while many a composer has delicately lifted other lyrical folk segments and incorporated them into his own larger musical forms.

The most important species of folk poetry is the madrigal. It is the only species that became the property of the cultivated poet, and it subsequently led to the formation and development of the great polyphonic school of writing. This form was enthusiastically adopted by the Flemish school of composers who found themselves in Italy as *maestri di cappella* (choirmasters). The word madrigal is derived from a song sung by shepherds (*mandriano*) while taking their flocks (*mandria*) to pasture. Some authorities trace the word to the Italian *madre* (mother), signifying a poem addressed to the Madonna, while others conceive it as a corruption of the Spanish *madrugada* (dawn), equivalent to the Italian *mattinata*.

Rome and Venice cultivated the madrigal with great success. In Florence it attained tremendous popularity, appearing initially in the form of the *frottola*. In Naples it took firm root and flourished as the villanella. Transplanted to England, the madrigal found a freedom of harmonic treatment which it did not possess under the quasi-ecclesiastical guidance of the Roman and Venetian schools. The Italian text was soon supplanted by the English. Although this deprived the madrigal of its original flavor, the lack was compensated by the enthusiasm the new form found in its adopted country. Subsequently, it was neglected by both the Flemings and the Italians, and it gradually evolved into a species of chamber music with instrumental accompaniment. In England, it merged into the glee, a form of composition cultivated in no other

country. Some English authorities regard the glee as aesthetically superior to its German complement, the part song. By achieving a harmonic elasticity and substituting the modern tonalities for the ecclesiastical modes, the madrigal form opened an avenue for further progress in part writing, directly influencing the great Germanic school, which was to bloom and flower with the chorale. Thus, the madrigal, a product of Italian poetic thought, profoundly influenced the whole course of music composition of its day.

The golden period of the Italian madrigal reached its apex in the works of Giovanni Giacomo Gastoldi (c. 1556–1619), Baldassare Donato or Donati (c. 1530–1603), and Luca Marenzio (c. 1553–1599), who was called *il più dolce cigno* (the sweetest swan) and was doubtless the leading madrigalist of his time. At the beginning of the 17th century, the madrigal was invested with a new dramatic element. We see it influence the chromaticism of the coming opera and oratorio, and a new lyrical trinity is found in the brilliant works of Carlo Gesualdo, prince of Venosa (c. 1560–c. 1614), Orazio Vecchi (1550?–1605), and the great Claudio Monteverdi (1567–1643). In his *L'amfiparnasso*, Vecchi touches upon the novel idea of madrigal-comedy and choral forms for the stage, intermediaries between the madrigalian formalism and the coming experimentalism of the Florentine Camerata. Gesualdo and his bold chromatic progressions were strangely prophetic of the Wagnerianism to come almost 300 years later. The introduction of the unique tremolo effects in the violin, first found in his *Il combattimento di Tancredi e Clorinda*, together with the use of massive harmonies and expert treatment of dissonances, stamps Monteverdi as one of the bold geniuses of musical history.

It is in the transitional decades linking the 16th and 17th centuries that we find the development of new forms on which modern music relies: opera, oratorio, and accompanied solo song. Imbued with a desire to revive the Greek classical ideals, a group of Florentine nobles, poets, and musicians banded together. Known as the Camerata (sometimes as Bardists), they met at the palace of Giovanni Bardi, conte del Vernio (1534?–1612) and at the home of Jacopo Corsi (1560–1604) to discuss plans for the revival of the tonal art of classical antiquity. The first practical experiment of this group, undertaken by Vincenzo Galilei (c. 1533–1591), father of the famous astronomer, was a musical setting of Count Ugolino's lament from Dante's *Divina Commedia*. Galilei was the most prominent figure in the work of the Camerata, and his interest in art prompted him to write *Il Fronimo*, a literary dialogue in which he explained the method of tuning, then in vogue by Italian lutanists. His theoretical studies in tuning were in juxtaposition to those of his teacher, Gioseffo Zarlino (1517–1590), who believed that the octave should be divided into 12 equal semitones, whereas Galilei, in his blind adherence to Greek ideals, insisted upon the Pythagorean immutable system.

Zarlino and his contemporary, Lodovico Zacconi (born Giulio Cesare Zacconi, 1555–1627), constituted a formidable brace of theorists of the late 16th century. Zacconi's fame rests on his valuable *Prattica di musica*, a series of four books published in Venice between 1592 and 1622, which, in conjunction with the *Dodecachordon* of the Swiss Henricus Glareanus (real name

Heinrich Loris), and the *Musicae activae micrologus* of the German Andreas Ornithoparcus (real name Vogelsang or Vogelgesang), comprise the only clear works explaining the musical practices of the day. An earlier and more celebrated treatise similarly entitled *Micrologus*, now in the library of the Vatican, was compiled by Guido d'Arezzo (995?–1050) about 1025, and printed in 1784 by Martin Gerbert von Hornau in his *Scriptores ecclesiastici de musica*.

In addition to his advocacy of equal temperament for keyed instruments, a practice which was adopted by Bach 100 years later and completely realized only in comparatively recent years, Zarlino assured his place in music history by his three tracts entitled: *Istitutioni armoniche* (1558), *Dimostrazioni armoniche* (1571), and *Sopplimenti musicali* (1588). His triple literary effort clearly paved the way for the major and descending minor scales of modern music. One of Zarlino's considerations takes us to the human pulse as a unit of music measurement. This same human measuring device was used by Galileo Galilei (1564–1642) in determining the theory of isochronous vibration, when he timed the oscillations of a swinging lamp in the Cathedral of Pisa by means of pulse beats and found that amplitude of oscillation did not affect the isochronism of a swinging pendulum. This proved conclusively that frequency, not amplitude, of oscillation affects the pitch of a vibrating body.

The work of the Camerata gained impetus with *Dafne* (*Daphne*), a dramatic poem (1594) of Ottavio Rinuccini (1562–1621), set to music by Jacopo Peri (1561–1633). This early effort was received with such acclaim that for three years it was repeatedly performed during the carnival season. The actual history of opera, however, may be said to commence with *Euridice* (*Eurydice*), a *dramma per musica* written by Rinuccini at the behest of Grand Duke Ferdinand I, with musical settings by both Peri and Giulio Caccini (c. 1550–1618). This opera was performed as part of the festivities in honor of the wedding of Henry IV of France and Marie de Médicis in the Pitti Palace on Oct. 6, 1600. At this performance part of Peri's and part of Caccini's music was performed. It included a few choruses in madrigal style with dialogue carried on in the *stile rappresentativo*. This *stile rappresentativo* was nothing more than the subjugation of melody to fit the natural emotional surge of the text. It later gave rise to the recitative and the aria as we know them today. The music contained many vocal flourishes. This was especially true of Caccini's work. These flourishes proved to be the contributing factors to the decline of opera before the advent of Verdi, Puccini, and the moderns of the operatic school in Italy.

It was left to the genius of Monteverdi to reveal the possibilities of this new form. In his *Orfeo*, we find a tremendous advance over the simple music dramas of the Florentines, and in his pupil Francesco Cavalli (originally Pietro Francesco Cavalli-Bruni, 1602?–1676), we discern an improvement in the recitative and discover the use of male sopranos (castrati) for the first time. Cavalli foreshadowed the *aria da capo*, which was to become so prominent a feature of opera for the Italians.

At the beginning of the 17th century some comedy was being injected into an otherwise

classic and formal music drama. It was, at first, considered out of place and relegated to the entr'acte. These comedies were called *intermezzi* or *opera buffa* and formed a distinct part of *opera seria*. Fittingly enough, they were developed in Naples, which wrested the operatic leadership from Florence and Venice. The Neapolitan pre-eminence is due principally to Alessandro Scarlatti (1659-1725), a musician of natural gifts and one of the most indefatigable workers of his time—his operas alone numbered over 108. Under his guidance, the recitative took three distinct forms—the *recitativo secco* (unaccompanied), the *recitativo strumentato* (used in moments of intensity with orchestral accompaniment), and the aria (for impassioned vocal soliloquy).

By this time the opera had become more and more a vehicle for vocal display. The chorus faded in importance, and the librettos gradually assumed the melodramatic form of love intrigue, leaving the classic Greek drama behind. By 1725, the singing virtuosos had attained such influence over the operatic composers that they actually dictated their demands. Their insistence on vocal display rapidly led composers to a kind of formality that contained the seeds of decadence and artistic sterility. The golden age of *bel canto* had descended upon Italy, but, blinded by sheer virtuosity and vocal beauty, together with a degeneration of literary taste, opera was brought to a temporary decline.

In Domenico Cimarosa (1749-1801) we have a culminating point of both *opera buffa* and *opera seria*. A contemporary of Wolfgang Amadeus Mozart, Cimarosa had a much simpler and less varied style than his younger rival of Salzburg. His great success was achieved with *Il matrimonio segreto* (first produced in 1792), a work heard to this day. In *opera seria* he contributed *Gli Orazii e i Curiazii* (1794), one of the strongest heroic pieces of its time. Cimarosa is important chiefly as a type of his era; he bridges the gap between the early classical opera and the period of romanticism.

If the Italian composers did not take kindly to the spirit of romanticism that spread throughout Europe, they could not evade it completely. Gioacchino Rossini (1792-1868) was among the first to revise his design and adjust his methods to fit the new lyrical attitudes. He headed a group of writers who assumed the responsibility of salvaging the opera from an ever-widening pit of decadence. A thorough technical mastery in treating the human voice, however, was the only compensation for the general musical impoverishment that prevailed. But Italy's operatic conquest of the world was by this time complete.

It is in this generation that we glimpse an incipient schism between the Italian and German styles. One path led to mythological figuration and metaphysical speculation, while the other clung desperately to living human characterization that mirrored the soul of the auditor himself. The northern temperament plunged into a sea of ponderous musical dialectics, while the southerner cast deep beams of illumination on the operatic horizon, returning with characteristic Latin candor and simplicity to limn human emotion on a stage peopled with human beings.

Rossini, Gaetano Donizetti (1797-1848), and the Sicilian Vincenzo Bellini (1801-1835)—the three giants of the period—while retaining the Italian love for lyricism, at the same time ef-

fected certain reforms and brought about many improvements upon which the moderns were destined to build. That the works of these men are heard today is eloquent proof of their excellence and intrinsic worth. Despite the sparkle and musical wit of his *Il Barbiere di Siviglia* (*The Barber of Seville*), Rossini's sincerest work was *Guillaume Tell* (*William Tell*). Here he shows a strength of orchestral technique which greatly influenced the French operatic writers of his time. The simplicity and dignity vested in the work prove that he could set aside the flimsy and conventional and attack the subject of Tell with seriousness and reserve.

Although Donizetti and Rossini worked equally well in *opera seria* and *opera buffa*, the young Bellini was successful only in the serious vein. Both his *Norma* and *La Sonnambula* (*The Sleepwalker*) show a delicacy and sensitivity that surpassed even the great Rossini himself. For mastery of melodic power, Bellini has no peer. Despite a certain naive quality and a strain of effeminate sentiment, he rises at times to a grandeur which is not often found in Donizetti. Although the latter did not possess the melodic gift of Bellini, yet there is ample compensation for it in his characterizations, such as that of Naffeo Orsini in *Lucrezia Borgia*, which, for brilliancy and fierce dramatic power, were not equaled during his period. Both composers sustained the Italian love for lyricism so well that Wagner, years later, fairly shouted his praise of them. Both were alive to the necessity for reforms in their day. Neither could stem the Rossinian popularity, nor could they cope with the popularity of the *floriture* (vocal flourish) and flowing cadences so dear to the heart of the singer. On the whole, opera at this period was a sickeningly sweet (although beautifully melodious), ear-tickling, sensuous form which lacked virility. Opera awaited the coming of Giuseppe Verdi for definitive reforms.

When the most delicate taste had tired of the Donizetti-Bellini *dolcezza*, Giuseppe Verdi (1813-1901) breathed new life and hope into this moribund institution of the Camerata. He brought to bear the earthiness, the refreshing virility, and the savage strength it needed. His genius ran the gamut from vulgar depths to soaring heights. A fearless, sincere, and genuine artist, he had as his most noteworthy trait the ability to grow artistically to the very end of his life. In his early operas—*Oberto*, *Nabucco* (*Nabucodonosor*), *I Lombardi*, *Ernani*—he showed stiffness and a groping for freedom. It is in his *Rigoletto* (1851), that he first revealed a freer and more original style. His development through *Il Trovatore*, *La Forza del Destino*, *Aida*, *Otello*, and *Falstaff* shows a steady, methodical, and inexorable climb to the pinnacle of operatic fame. Mention must be made of his contemporary, Arrigo Boito (1842-1918), librettist and composer in his own right, without whose encouragement the world would probably never have heard *Otello* or *Falstaff*.

With the close of the 19th century, Italy saw a movement by her younger composers toward operatic story dealing with folklore and the everyday, prosaic existence in the provinces. In this group were Pietro Mascagni (1863-1945) and Ruggiero Leoncavallo (1858-1919), whose programmatic use of thematic material gave rise to the school of *verismo* (verism or realism). Both *I Pagliacci* of Leoncavallo and *Cavalleria*

Rusticana of Mascagni were products of this period. Both operas were built on popular folk legends; both were brilliantly orchestrated and achieved great popularity.

Out of the school of *verismo* came Giacomo Puccini (1858–1924), whose works have attained a great vogue. He was a sensitive artist with an active imagination, but his predilection for an expansive melodic phrase, extending even to those textual passages not warranting such treatment, has been criticized. Subsequent operatic successes were realized by a group of composers including Alfredo Catalani (1854–1893), Alberto Franchetti (1860–1942), Francesco Cilea (1866–1950), Riccardo Zandonai (1883–1944), Franco Alfano (1877–1954), the well-known Italo Montemezzi (1875–1952), who wrote *L'amore dei tre re* (*The Love of Three Kings*); Amilcare Ponchielli (1834–1886), author of *La Gioconda* and teacher of Mascagni; Umberto Giordano (1867–1948) with his *Andrea Chénier*; and Ermanno Wolf-Ferrari (1876–1948), whose *I gioielli della Madonna* (*The Jewels of the Madonna*) and *Il segreto di Susanna* (*The Secret of Susanne*) are very popular in the United States.

The popular view that Italian music concerns itself with problems of the theater only, has obscured the fact that Italy has given birth to many instrumental and dance forms. A cursory glance at the 16th and 17th century musical files reveals a wealth of material conclusively dispelling this misconception. No doubt, this mistaken belief was fortified by the fact that Italians have been purveyors of opera to the entire world. The overwhelming successes of the 18th and 19th century Italian theatrical enterprises, which influenced the entire Continent and had subsequent repercussions in England and the United States, contributed further to this warped viewpoint. The complete acceptance of operatic art by the musical world was inevitable, since it dealt with fundamental elements of human expression in its use of voice and gesture. Their coordinated use, joined with the power of sound, make for simple understanding as contrasted with symphonic complexities, which too often are poverty stricken in meaning. The psychology of sound is such that it comes closest to comprehension when it attains some kinship with the emotional tensions and releases of everyday experiences. It is precisely in this field that the Italian excels.

Italian melodic ingenuity gained impetus in the Middle Ages, when Gregorian art predominated. The subsequent unfolding of the Italian *Ars nova* (14th century music) reveals the acquisition of thirds and sixths as an advance over the simple organum of the Middle Ages. In Gioseffo Zarlino's *Istitutione armoniche*, we find mention of the untutored singers, who invariably sing the major third and sixth, at that time considered dissonant. Often the compositions of the *Ars nova* were aided by instruments reinforcing the voices which they accompanied.

While the Flemish group of composers in Italy relied heavily upon instruments, the Italians developed a purely vocal style that stands to this day as a supreme example of beautiful writing. This style was perfected by Giovanni Pierluigi (called da Palestrina, 1525?–1594), who stripped all artifice from his work to the end that exquisite melody and skillful use of declamation be happily united. In Palestrina we see the seed of a harmonic sense in the modern manner. The Roman Palestrinian orbit must include his pupil

Giovanni Maria Nanini or Nanino (1545?–1607), well known through his motet *Hodie Christus Natus Est*; Marco Antonio Ingegneri (1545?–1592), whose *Responsoria Hebdomadae Sanctae* (*Responses for Holy Week*) were at one time considered a work of Palestrina; Felice Anerio (1560?–1614), whose *Adoramus Te, Christe*, has erroneously been attributed also to Palestrina; and Gregorio Allegri (1582?–1652), known principally for his world-famous *Miserere*.

While the Roman school was occupied with compositions for church use, the northern school of the Venetians was founding an independent form of organ and orchestral composition. Andrea Gabrieli or Gabrieli (c. 1510–1586), through his *Agnus Dei* for five voices, was achieving antiphonal effects with double choirs at St. Mark's, while his nephew Giovanni Gabrieli (1557–1612), with his *Sonata Pian e Forte* and the instrumental *Canzone* for two violins, two cornets, and two trombones, was a pioneer in instrumental forms. Simultaneously these Venetians were perfecting the *ricercare*, precursor of the fugue; and Claudio Merulo (real surname Merlotti, 1533–1604), predecessor to Giovanni Gabrieli as first organist at St. Mark's, was developing an improvisational form in his toccatas. These *canzoni, ricercari*, and toccatas represent the transitional polyphonic forms linking the purely vocal art with early orchestral composition.

The first formal sonata imprint is to be found several generations later in Arcangelo Corelli (1653–1713), who established the four-part, slow-fast alternation that was to prevail up to the middle of the 18th century, when it evolved into the threefold fast-slow-fast conception. There were two types of sonatas in Corelli's day: the *sonata da camera* (chamber sonata) and the *sonata da chiesa* (church sonata). Continuing the work of the Venetians in establishing free forms in organ music, the Roman Girolamo Frescobaldi (1583–1643), sometimes known as the Italian Bach, extended, elaborated, and perfected all the accepted ideas which were to form the basis for the contrapuntal art of his northern musical brothers. A little later, we see a new type of instrumental music in the form of concerto where the solos and tutti were, at first, known as *concerto grosso*, and several soloists were employed in opposition to the *tutti* effects. The *sinfonia* (symphony) appears as a later development through the genius of Alessandro Scarlatti, in the form of an orchestral introduction to opera. Here is the birth of the overture consisting of three movements: an allegro, then an adagio or andante, followed by an allegro, usually in dance form. The sonata and concerto adopted this structure, while the symphony divorced itself from the opera and became the pedestal for all instrumental music to this day.

A prolific writer, Scarlatti penned over 108 operas, perhaps 200 masses (though only 10 are extant), and approximately 700 cantatas and oratorios. He stands at the head of the Neapolitan school. Another specialist in church music of this period was Francesco Durante (1684–1755), with his masses, psalms, motets, and hymns. Antonio Lotti (1667–1740) stands high in the esteem of the church for his *Crucifixus* for six voices, in addition to his numerous masses, while Benedetto Marcello (1686–1739) is remembered for his keenly biting work *Il teatro alla moda*, directed at operatic abuses then in vogue, together with his famous settings for the first 50 psalms.

Giovanni Battista Pergolesi or Pergolese (1710-1736) and his *Stabat Mater* are products of this period. Lesser representatives of church art include Giovanni Battista (known as Padre) Martini (1706-1784) of Bologna and Antonio Caldara (1670-1736). In recent times the great *Manzoni Requiem* of Verdi stands supreme, while the works of Lorenzo Perosi (1872-) attempt to recapture the ecclesiastical traditions of Palestrina.

The development of instrumental forms was matched by the instrumentalists and instrument makers, who were quick to seize upon new ideas and adapt them for their own use. In the field of violin makers were Andrea Amati (1530?-1611), Gasparo da Salò (real name Bertolotti, c. 1542-1609), and Antonio Stradivari (1644-1737), who improved the acoustical quality of the instrument. The Guarneri or Guarnerius family of Cremona (latter half of the 17th century) was interested mainly in strength of tone. In the field of the solo violin concerto, we find the names of Antonio Vivaldi (1678?-1741), Giuseppe Tartini (1692-1770), Gaetano Pugnani (1731-1798), and Pietro Antonio Locatelli (1693-1764), while the romantic figure of Nicolò Paganini (1782-1840) conjures up visions of demoniac techniques that have never been surpassed. The development of the piano by Bartolommeo Cristofori (1665-1731) to an instrument to be played *pian e forte* (soft and loud), whence it receives its name, opened vistas in composition for that instrument.

The heroic march of Italian music is one vast accumulation of tonal art through the centuries. Since the early 18th century, the Latin temperament has shown a marked preference for music of the theater, and the world has gratefully accepted the fruits of Italian lyrical genius. There is, however, another and very different Italy immeasurably removed from the spell of *verismo* and the lovelier terrain of Giovanni Sgambati (1841-1914), Giuseppe Martucci (1856-1909), Marco Enrico Bossi (1861-1925), and Leone Sinigaglia (1868-). The neoclassicism of the 20th century has its roots in Italy, and its initial efforts were given impetus by the gigantic musical intellect of Ferruccio Busoni (1866-1924). This movement marked the revolt against the romantic and postromantic subjectivism of the 19th century. The modern harmonic fabric enlists the creative power of Ildebrando Pizzetti (1880-), Riccardo Pick-Mangiagalli (1882-), and Francesco Malipiero (1882-). Mario Castelnuovo-Tedesco (1895-) and Vincenzo Tommasini (1880-) still cling to romantic remnants, although Tommasini's later works are neoclassic in style, while Ottorino Respighi (1879-1936) harks back to classical sources for his *Antiche danze e arie per liuto* (*Old Airs on Lutes*). A prolific composer in all forms, Respighi will be remembered chiefly for his handling of orchestral techniques, although his operas, *Maria Egiziaca* (*Mary of Egypt*), *Belfagor*, and *La Campana sommersa* (*The Sunken Bell*) have weathered the test of frequent performances. Vittorio Rieti (1898-) and Ruggero Vené (1898-) carry on their master's orchestral traditions. Rieti has achieved his greatest successes with the ballets *Noah's Ark* and *Barabau*, produced by Sergei Diaghilev. Lodovico Rocca (1895-) stands somewhat alone with his programmatic music, although one of his five operas, *Il dibuk* (*The Dybbuk*), based on a Hebrew legend, was produced at La Scala with great success in 1934.

Further revulsion against romantic sentimentalism and the pastel colorations of impressionism led to a mercifully short-lived movement representing extremely radical methods in all the arts in the cult of *futurismo* (futurism). Its musical tenets were, in part, outlined by Francesco Pratella (1880-) in his *Musica futurista* (1912). Futuristic music embodying new musical resources of nonperiodical vibrations was written by Luigi Russolo (1885-), who constructed noise instruments (*intonarumori*). Though unsuccessful, this movement spread to France, where *bruitisme*, as the French called it, may be tersely summarized by Jean Cocteau's observation on impressionism: "After the music of the silk brush, the music with the axe."

In the vanguard of young and extremely active composers delving into Arnold Schönberg's twelve-tone mechanisms is Luigi Dallapiccola (1904-), whose *Volo di notte* (*Night Flight*), based on an excerpt from a book by Antoine de Saint-Exupéry, uses a twelve-tone (called dodecachordal by Italians) melodic series. An integral application of the dodecachordal technique is found in his *Greek Lyrics*. Ennio Porrino (1910-), Antonio Veretti (1900-), Virgilio Mortari (1902-), Nino Rota (1911-), Riccardo Nielsen (1908-), and Giorgio Federico Ghedini (1892-) are members of this school. Luigi Cortese (1899-), a polytonalist, is known principally for his *Prometheus Bound*, while Adone Zecchi (1904-) applied his twelve-tone technique to his *Requiem for Men's Voices and Orchestra* (1943) and his *Invectives* for the same combination. Goffredo Petrassi (1904-), a neo-classicist who occasionally ventures into quartal harmony, achieved a degree of fame beyond Italian borders with his *Partita for Orchestra* (1933), while Renzo Rossellini (1908-), a neompressionist occupied principally with music for films, was introduced to New York audiences in 1946 through his *Canto de Palude* (1938).

At least three Italian Americans occupy a prominent place in the musical scene of the United States. Gian-Carlo Menotti (1911-) is justly famous for his operas *Amelia Goes to the Ball* (1937) and *The Island God* (Metropolitan Opera House, 1942); his charming radio opera *The Old Maid and the Thief* (1939); and his more recent works, *The Medium* (1946) and *The Telephone* (1947). Walter Piston, born in Maine in 1894, leaped to fame with his ballet *The Incredible Flutist* (1938), while Paul Creston, born in New York in 1906, is known principally for music in the symphonic medium.

The Italian directorial genius is a recognized commodity and precludes extended comment. Besides Arturo Toscanini (1867-), its stellar light, it includes Bernardino Molinari (1880-), Victor de Sabata (1892-), whose compositions have been heard in the United States, Gino Marinuzzi (1882-1945), Antonio Guarneri (1883-), Leopoldo Mugnone (1858-1940), Verdi's favorite conductor, and Sergio Failoni (1890-1947).

The tremendous national interest in music and its makers keeps over 30 publications busy chronicling the musical events in the peninsula. Among the leading contributors in the field of musicology are Guido M. Gatti (1892-), *La Rassegna musicale*, Fausto Acanfora di Torrefrancia (1883-), *Revista musicale italiana*, Fernando Liuzzi (1884-1940), Andrea della Corte (1883-), and Guido Pannain (1891-). Over 400 societies devote themselves exclusively to chamber music.

The Società del Quintetto has toured the Continent as well as Italy, while the Venetian Quartet and the Trio Italiano have toured as far afield as South America. The Gruppi Universitari Musicali—comprising students from 18 universities, with its Poltronieri Quartet—and the Corporazione delle Nuove Musiche concern themselves with ancient and new music in Rome, Milan, and Palermo. The ladies' lyceum clubs display a keen interest in new music.

Modern Italian music, endeavoring to revive symphonic forms of native caliber, spells grandeur, austerity, robustness, and conciseness—traits ordinarily associated with such old composers as Corelli, Monteverdi, and Scarlatti. Despite slight influences of French impressionism, Stravinskian primitivity, and Schönbergian complexities, its chief characteristic remains an Italianate lyricism. The postwar endeavors to settle regional differences should restore Italy to her historic position as chief purveyor of music to the world. See also separate biographies of the major composers.

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8. SCIENCE. We cannot give an account of the progress of the experimental sciences in Italy from the beginning of the 17th century to the mid-20th century—from Galileo Galilei to Enrico Fermi—without reference to the political history of that period. There is a relationship of cause and effect between political and economic conditions and the material possibilities of carrying out research and experiment. The 17th century was a golden age for science in Italy and elsewhere. Probably even without Galileo, Sir Isaac Newton (1642–1727) would have made a contribution to physics as great as that of his Italian predecessor. But apart from the time lag between the two physicists, we must not overlook one striking and entirely original element in Galileo's work—namely, his break with Aristotelian tradition as revived by the Roman Catholic Church. It was this break that permitted not only the creation of a new science, but also the rise of a whole new spirit of inquiry, embodied in what we now call experimental research. Galileo lived at a particularly happy period for the

Italian universities, when both Padova and Pisa were in a position to subsidize scientific laboratories. Of course, any visitor to Pisa is impressed by the primitive equipment of the places where Galileo carried on his famous experiments with falling bodies, but they involved what were, for his times, considerable expenditures, certainly no less than those made for similar purposes by other European universities. This availability of funds accounts in part for the rapid growth of experimental science in the 17th century. Another factor of importance was the incipient conflict between the rising middle class and the old aristocracy.

The following period presents us with an entirely different set of conditions; indeed, in Italy the late 17th and the 18th centuries were times of political decadence. There was a shattering of the ideal of unity spread through the peninsula by the Renaissance and even a decay of the wealthy middle class. The discoveries of Marcello Malpighi (1628–1694), Luigi or Aloisio Galvani (1737–1798) and Alessandro Volta (1745–1827) would surely have led to further theoretical development and practical application within Italy had they found a more propitious political and economic environment. As it was, the voltaic pile attained recognition under the more favorable circumstances enjoyed by Sir Humphry Davy in England. It is no wonder, then, that experimental science declined in 18th century Italy, and that such first-rate talents as there were in this field did not assert themselves as they should, because a proper background was lacking.

The 19th century completes the picture we have sketched in above. Political and social conditions in Italy up to 1870 and unification did not favor the efficient organization of the universities or their laboratories. But with political unity and Italy's entrance into the ranks of industrial nations, there came a renewed impulse, made possible by grants of funds, toward activities in the field of science. From 1880 to 1914, Italy made scientific progress of a truly remarkable kind. Had it not been for the political degeneration of the Fascist period, this progress would have continued and been proportionate to the important role traditionally played by Italians among the civilized peoples of the world. In Fascist Italy a man like Fermi could not find scope for developing his creative genius, whereas under a democratic government he could have carried out his work in line with the great Italian contributions to progress and civilization.

The Age of Galileo.—We cannot understand the 19th century development of experimental science in the Galilean tradition unless we take into account the cultural and technical conditions prevailing in Italy since the Renaissance. "The appearance of a Leonardo or a Galileo is comprehensible only if we connect it with Italian industry," writes Harald Höffding in his *Den nyere Filosofis Historie (History of Modern Philosophy, 1894)*, and as Gabriel Séailles, the art historian, said in his *Léonard de Vinci: l'artiste et le savant* (1892): "A hundred years before Galilei there was in Italy a small group of free men whose minds were not cluttered up with excessive erudition. . . . They observed the sky and the earth, the life of plants and animals. . . . They made experiments, they went in for empirical and mathematical thinking, because they refused to accept anything as true that could not pass the test of demonstration and be proved by

the evidence of their own senses. They were aware that science represents a collective, social effort, that one man cannot build it up in a hurry, because it does not spring fully formed from his mind. For this reason, they met together, questioned one another, and exchanged news of their studies and discoveries. We may say that in the 15th century a group of artists, travelers, doctors, engineers, and gentlemen were the leaders of modern science."

Another valuable source of information about social and cultural conditions in Italy at this time is Jakob Burckhardt's classic work, *Die Kultur der Renaissance in Italien* (*The Civilization of the Renaissance in Italy*, 1860). Galileo Galilei (1564-1642) himself, at the beginning of his *Discorsi e dimostrazioni matematiche intorno a due nuove scienze* (*Dialogues Concerning Two New Sciences*, 1638) said: "The constant activity which you Venetians display in your arsenal suggests to the studious mind a large field for endeavor, especially that part of the work which involves mechanics." The rise of experimental science in 17th century Italy is an example of the interaction of technology and scientific development.

Although we are not chiefly concerned with Galileo's contributions to astronomy, we must note the influence of his *Sidereus nuncius* (1610) and *Istoria e dimostrazioni intorno alle macchie solari* (*Letters on the Solar Spots*, 1613), his development of the refracting telescope, and his discovery of the satellites of Jupiter, sunspots, the phases of Venus, the first traces of the ring around Saturn, and planetary orbits. His two principal scientific achievements, however, may be summarized as follows:

(1) *Experimental method*, of which he must be considered the founder, although nowhere in his writings has he given a detailed description of methodology or naturalistic logic. It would require considerable effort to coordinate the analyses of his sensations and experiments which we find scattered through *Il saggiaiore* (1623), the *Dialogo dei due massimi sistemi del mondo* (1632), and the *Discorsi e dimostrazioni matematiche intorno a due nuove scienze*. Connected with his use of the experimental method are his study of the resistance of various materials, particularly cylindrical and prismatic rods fixed at one or both ends; his calculations for the first rangefinding tables, based on his study of the motion of projectiles; and his study of the speed of light.

(2) *Foundation of dynamics and of experimental physics*. Galileo gives us in the *Discorsi* the theory of inertia and the laws that govern the motion of bodies falling through air or on an inclined plane, particularly the law that relates time and distance in uniformly accelerated motion, and the law governing the fall of bodies in a vacuum. (Although the laws of motion were conceived by Galileo, however, they were not definitely formulated until Newton.) Galileo did not use formulas in his work, but he did employ geometrical methods of demonstration. Closely allied to the foregoing is his discovery of the isochronism of the pendulum, found in the *Dialogo* along with the idea of the inertia frame of reference, a conception also called Galilean relativity. Besides demonstrating these laws and principles, Galileo based his work on axioms and postulates that were in direct contradiction to Aristotelian physics and have survived as classics

of mechanics. He also made various technical inventions of great importance to scientific progress, such as the development of the telescope, the pendulum equipped with a counter, which may be considered a predecessor of the pendulum clock made quite independently by the Dutch scientist, Christian Huygens or Huyghens, in 1656, and the geometric and military compass (1597).

Galileo created a school of scientists, some of whom left their mark in the history of science. The greatest of his pupils was Evangelista Torricelli (1608-1647). Out of Torricelli's experiments on the rise of water in pumps, which he attributed to external pressure, came the invention of the barometer (1643). He also made discoveries in the field of geometry (*Opera geometrica; De motu gravium*) which drew the attention of René Descartes and Huygens and paved the way for the later discoveries of Blaise Pascal and Newton.

Other scientists in the orbit of the school of Galileo were the mathematician Bonaventura Cavalieri (1598-1647), who created the method of indivisibles, and Giovanni Alfonso Borelli (1608-1679), one of the most renowned members of the Accademia del Cimento and founder of a school of iatromechanics. His most significant work is *De motu animalium* (1680-1681), in which he sought to apply mechanical principles to animal movements. It is within the tradition of Galileo that we must also mention Domenico Guglielmini (1655-1710), whose *Riflessioni filosofiche dedotte dalle figure dei sali* (*Philosophical Reflections Based on the Configurations of Salt*, 1705) was a fundamental step in the development of crystallography.

The conditions that favored the rapid development of experimental science as conducted by Galileo and his pupils were equally favorable to chemistry, as is shown by the publication of the treatises *De la pirotechnia* (1540), by Vannoccio Biringuccio (1480-1539); *I tre libri dell'arte del vasaio* (*Three Books on the Art of Pottery*, 1548), by Cipriano Piccolpasso (1524-1579); Rosetti's *Pictio de l'arte dei tentori* (*The Art of Dyers*, 1540); *Magia naturalis* (*Natural Magic*, 1558) by Giambattista della Porta (1538?-1615); and *De arte vitraria* (*The Art of Glassmaking*, 1612) by Antonio Neri (d. 1614). We must also call attention to the earlier physician and botanist, Andrea Cesalpino (1519-1603), who was influenced by the same environment that paved the way for Galileo and his school.

In the second half of the 17th century and during the greater part of the 18th century, Italy, unlike England and France, fell into a period of political and social decay. In order to find a real sequel to the Galilean tradition, we must pass on to the three great scientists of the end of the 18th century: Galvani, Volta, and Spallanzani.

Early Nineteenth Century.—Luigi or Aloisio Galvani, student of Jacopo Bartolomeo Beccari (1682-1766), with his *De viribus electricitatis in motu musculari commentarius* (1791), was a pioneer in the study of the physiological action of electricity. He observed that when the ends of a metal strip were placed against the lumbar nerves and muscles of a frog a spark was produced. This electricity he attributed to the frog, thus entering into controversy with Count Alessandro Volta, who, as a result, made a further study of the phenomena. This led in turn to the discovery of the voltaic pile (1800), a landmark in the de-

velopment of electricity and hence of modern civilization. Volta also studied the composition of marsh gas, perfected the udometer, and expounded the law governing the expansion of air at high temperatures. Lazzaro Spallanzani (1729-1799), who taught at the University of Pavia, made experiments in fertilization, disproving the theory of spontaneous generation, and wrote an account of his travels which was a considerable contribution to natural science.

During the first half of the 19th century, Italy's political condition, particularly the fact that the peninsula was split up into a number of small states, served to retard its technical progress in comparison with that of other European nations. It is not surprising, therefore, that scientific research should have fallen behind. Nevertheless some great things were accomplished, so that the Italian contribution to science continued to be of primary importance. The most distinguished Italian scientist of the period was Count Amedeo Avogadro (1776-1856), professor of physics at the University of Turin. His truly great scientific accomplishment was the formulation of the molecular theory, which developed the atomic discoveries previously made by John Dalton. Avogadro stated that there are particles known as molecules (compound molecules), which are made up of two or more atoms and may be broken down by a chemical reaction into their component atoms, or simple molecules. "On the basis of this hypothesis," Avogadro said, "we have a fairly easy means of determining the relative masses of molecules of bodies in a gaseous state and the relative number of these molecules in combinations, because the relations among the masses of molecules correspond to those of the densities of the various gases at the same pressure and temperature, and the relative number of molecules in any combination is obtained from the relationship among the volumes of gas of which it is made up." He is stating in this hypothesis, which is based on Joseph Louis Gay-Lussac's law of volumes, that there is no difference between volume and molecular mass—that the weight of the molecules is proportionate to their density, so that if we know the density then we know the molecular weight as well.

Avogadro elaborated his hypothesis in several fundamental studies, among them the *Trattato della costituzione generale dei corpi* (*Treatise on the General Constitution of Bodies*, 1837-1841), but his ideas failed at first to interest chemists, in part because he had not proved them experimentally. They found full acceptance only after his death, but his work became the basis of Cannizzaro's improvement upon Dalton's statement of the atomic theory.

Stanislao Cannizzaro (1826-1910), a student of Raffaele Piria, in his *Sunto di un corso di filosofia chimica* (*Short Course of Chemical Philosophy*, 1858), laid the experimental basis of modern atomic theory. Cannizzaro worked on already familiar ground to accomplish a necessary coordination of the theories of Avogadro with the results of another 50 years' experimentation. He gathered together the conclusions reached by Dalton, Avogadro, André Ampère, Marc Antoine Gaudin, and the later Jean Baptiste Dumas, Jöns Jakob Berzelius, Charles Frédéric Gerhardt, and Auguste Laurent, and established a clear distinction between molecular and atomic weights. He stated that the various quantities of the same element contained in different molecules are all

whole multiples of one quantity, which, because it always forms a single unit, properly deserves the name of atom. The value of this law transcends that of Avogadro's hypothesis because it gives a rigorous interpretation of the facts. Cannizzaro's clarification of the concept of atomic weight also went far toward the establishment of the theory of valence. Another of his contributions was the impulse he gave to scientific research by the setting up of well-equipped laboratories in both Palermo and Rome. Italian chemistry of the second half of the 19th century bears a strong imprint of the work of this great scientist, who also played an important role in the political life of his time.

Exchanges with other countries, particularly France and Germany, gave still more Italians a chance to make themselves known. Faustino Malaguti (1802-1878), a political exile who lived in France, was only one of the many notable chemists to emerge in the early part of the century. Ascanio Sobrero (1812-1888), a pupil of Théophile Pelouze and Justus von Liebig, discovered nitroglycerin. In 1852, Luigi Chiozza (1828-1889), a professor in Milan and a participant in Gerhardt's classic research in the field of the anhydrides of organic acids, discovered and made a synthesis of carbostyryl and studied the effects of alkalis on unsaturated acids. Raffaele Piria (1814-1865), who taught at Pisa and Turin, introduced new methods of synthesis, did fundamental research on salicin, populin, tyrosine, and aspartic acid and, in 1838, discovered salicylic acid. Cesare Bertagnini (1827-1857), a pupil of Piria and professor at Pisa, obtained a synthesis of cinnamic acid and did research on oxamide, phyllyrin, and the alterations undergone by certain organic acids in animal organisms.

Physics shared the position of chemistry in the mid-19th century, and had its share of distinguished practitioners. Ottorino Fabrizio Mossotti (1791-1863), whose reputation extended beyond the borders of Italy, did painstaking research in molecular physics and was a pioneer of mathematical physics in Italy. Macedonio Melloni (1798-1854), a Neapolitan liberal forced to leave his professorship in Parma after the insurrections of 1831, did much of his work in exile, in Geneva and Paris. Later, after he had returned to Naples, he founded Vesuvius Observatory (1847), did research in the fields of electricity and optics, with special attention to radiant energy, and established the identity of the energies of light and heat. He studied the thermal absorption of bodies, which he termed diathermancy, and discovered the spectrum of various kinds of heat emission. Carlo Matteucci (1811-1868), a friend of Piria who also took an interest in politics, investigated the physiological effects of electricity and worked to spread acceptance of atomic theory. He deserves further praise for having contributed, along with Piria, Pacinotti, and others, to the foundation in 1855, of the famous journal of physics, *Il Nuovo Cimento*.

Astronomy, geology, and mineralogy also produced scholars worthy of note in the first half of the 19th century. Father Pietro Angelo Secchi (1818-1878) directed the astronomical observatory of the Roman College and studied the spectrum of the fixed stars. Giovanni Virginio Schiaparelli (1835-1910), director of the Brera Observatory in Milan, is remembered for his important studies of the planet Mars and of comets. Annibale Riccò (1844-1919), geophysicist and as-

tronomer, studied Mount Etna, and also the relation between sunspots and protuberances. Among vulcanologists and seismologists the best known is Father Antonio Stoppani (1824-1891), who created a school of geology. Besides going in very actively for research, he wrote with great facility and his books spread the love of nature among the general public.

The Modern Period.—Italy's slow development of a national character, achieved only with the accomplishment of political unity, is reflected in the field of scientific research. Many scientists had only the scantiest means to enable them to pursue their studies, not a few of them took part in the political struggles of the time, and some were forced into exile. All this was tragic for science. After 1870, through the efforts of Quintino Sella (1827-1884), a man of modest scientific accomplishments, but a first-rate statesman, Italian universities were endowed with well-equipped laboratories, which soon stimulated scientific research. The period from 1870 to 1914, that is from the achievement of national unity to World War I, is of capital importance for scientific progress in Italy. This period deserves more detailed study, which should be linked with the history of Italian industry. Another very important factor in experimental science was the rapid development of mathematics.

Mathematics.—The mathematical tradition of the Italian Renaissance was revived in the late 19th century by a number of outstanding figures. They included Enrico Betti (1823-1892), who taught physics and mathematics at Pisa and was a pioneer topologist; Francesco Brioschi (1824-1897), a professor at Milan and a politician, who studied the theory of invariants, equations, and elliptic functions; Eugenio Beltrami (1835-1900), who took up non-Euclidean geometry and laid the foundation of mechanics in curved spaces; Luigi Cremona (1830-1903), who studied graphical statics and projective and algebraic geometry; Ulisse Dini (1845-1918), who taught at Pisa and made a profound study of the basis of the theory of the functions of real variables; and Luigi Bianchi (1856-1928), who left behind him important work in differential geometry. Giuseppe Peano (1858-1932), a professor at the University of Turin and a student of symbolic logic, indicated in his *Principi di geometria logicamente esposti* (*A Logical Exposition of the Principles of Geometry*, 1889), every logical proposition with symbols and developed the fundamentals of arithmetic and geometry in a rigidly rational but simple and intuitive manner.

Among other mathematicians were Giuseppe Veronese (1854-1917), who studied the geometry of hyperspaces; Corrado Segre (1863-1924), a professor at the University of Turin and a distinguished scholar in the field of algebraic and projective geometry; and Vito Volterra (1860-1940), of the University of Rome, who investigated analytic functions, hyperbolic and integral equations, and functional calculus. Tullio Levi-Civita (1873-1942), a professor at the universities of Padova and Rome, achieved far-reaching results in calculus, was a forerunner of the theory of relativity, and in 1918 introduced the notion of parallelism in curved spaces. Finally, Federico Enriques (1871-1946), a professor at the universities of Bologna and Rome and a positivist philosopher, is known for his book *Problemi della scienza* (*Problems of Science*, 1906), containing studies in arithmetic and analytic geometry.

Chemistry.—The mathematical discoveries formed the basis for chemical research in Italy. Its organization was due in large part to Cannizzaro, who, aside from his atomic studies, was a great organic chemist. The Cannizzaro reaction, which bears his name, led to the discovery of benzyl alcohol (1853), and to his research on santonin and its derivatives. He created a school of original research scientists whose leaders in turn enriched the various branches of chemistry. The most important of them were Emanuele Paternò, marchese di Sessa (1847-1935), Giacomo Luigi Ciamician (1857-1922), and Raffaello Nasini (1854-1931).

Paternò taught at the universities of Palermo and Rome and was also vice president of the Italian Senate. Soon after François Marie Raoult's work on cryoscopy, he investigated the molecular weight of dissolved substances (1886), and did research in the field of photochemistry, and on phosgene, polysulphides of hydrogen, and fluorides. Along with Cannizzaro, Ugo Schiff (1830-1915), and others, Paternò founded *La gazzetta chimica italiana* (1871), Italy's foremost chemical journal.

Ciamician was a professor at the universities of Padova and Bologna, chiefly known for his studies of the chemistry of pyrrole, the chemical action of light, and the behavior of alkaloids in plants. Nasini taught at the universities of Padova and Pisa. He popularized the electrolytic dissociation theory, worked on the refractivity of organic compounds in relation to their chemical composition, and studied the natural gases of Italy, the boracic exhalations of Tuscany, and the chemistry of many natural mineral waters.

Among Cannizzaro's students we must not forget Amerigo Andreocci (1863-1899), professor of pharmaceutical chemistry at the University of Catania, who is known for his studies of pyro-diazole, santonin, and triboluminescence. An illustrious contemporary of Cannizzaro was Francesco Selmi (1817-1881), professor of pharmaceutical chemistry at the University of Bologna, who distinguished the ptomaines and did research, which preceded that of Thomas Graham, on the colloids.

We find few great names at this time in the field of inorganic chemistry, if we except that of Augusto Piccini (1854-1905). But organic chemists in great numbers have left their names attached to some discovery or a new line of research in their field. Angelo Angeli (1864-1931), a student of Ciamician and professor at Florence and Palermo, discovered in 1896 nitro-hydroxylamine and made a noteworthy contribution to the knowledge of pyrrole derivatives and of nitrous compounds. Giorgio Errera (1860-1933), a professor at Palermo and Pavia who gave up his teaching rather than take the Fascist oath of allegiance, studied the chemistry of terpenes. Icilio Guareschi (1847-1928), of the University of Turin, worked chiefly in organic chemistry, toxicology, and chemical history, and conducted experiments with asparagine, urea, and naphthalene derivatives. He made a significant contribution to the chemistry of the ptomaines and the synthesis of hydropyridic compounds. Bernardo Oddo (1882-1941), a professor at the University of Pavia, was one of the most distinguished organic chemists of the early 20th century. Among his researches was a study of the reductive action of ethylaniline on Grignard's reagent. At the same time, he enriched the chem-

istry of the pyrrole and indole group with the preparation of derivatives of these two compounds.

Physical chemistry came to be the object of special study in Italy after the diffusion of Svante Arrhenius' theory of electrolytic dissociation. One of the pioneers in this field was Raffaello Nasini, at the end of the 19th century. The Gibbs-Roozeboom theory of phase rule opened wide possibilities of research in the field of metallography, in which we must count among the most important scholars Federico Giolitti (1880-1946), professor at the Polytechnic Institute of Turin and later an industrial consultant.

Industrial chemistry has a more modest history because up to the beginning of the 20th century there was no real chemical industry in Italy except in perphosphates and mineral acids. Luigi Gabba (1841-1916) of the Polytechnic Institute of Milan was a pioneer of teaching in this field, and his successor, Ettore Molinari (1867-1926), studied the action of ozone on unsaturated compounds, particularly oleic acid. Luigi Casale (1882-1927) introduced into Italy the process of synthesis of ammonia under high pressure, a method which has been applied in other countries, including the United States. In connection with the synthesis of ammonia we must mention Giacomo Fauser (1892-), engineer and director of the Montecatini Company, who obtained the synthesis under medium pressure. Fauser, the best trained technical chemist of modern Italy, brought about certain modifications of the technique of hydrogenation or cracking of the petroleum found in Albania. The economic self-sufficiency and isolation aimed at by the Fascist regime had very bad effects on the Italian chemical industry. Industrial chemistry depends on scientific research, which was retarded by World War II and by the deficiencies of many young teachers whose jobs had been secured by political influence rather than scholarly merit.

Biochemistry dates from Baron Justus von Liebig's *Die Chemie in ihre Anwendung auf Agrikultur und Physiologie* (1840), and Italy has had three great practitioners in this field. Gino Galeotti (1867-1921) was one of the first in Italy to apply the methods of physical chemistry to the study of physiological processes. Filippo Bottazzi (1867-1941) created a school for the study of biochemistry at the University of Naples, where he taught for a long time, and his *Trattato di chimica fisiologica* (*Treatise of Physiological Chemistry*, 1898-1899) had for 30 years a great influence in this field. Luigi Sabbatani (1863-1928) is responsible for the physico-chemical interpretation of many toxic processes.

Other chemists and physiologists contributed to biochemical studies. Among the glucosides we have Piria's studies of salicin (1838), and Bertagnini's of phillyrin (1854). When Piria submitted salicin to the action of warm, dilute acids and to that of emulsin, he discovered its glucosidic character and cleared up the nature of saligenin. In 1855, he proved that populin, discovered by Henri Braconnot in 1830, was a derivative of benzoysalicin. Bertagnini observed that phillyrin is a glucoside, and when heated with dilute acids it breaks up into glucose and phillygenin. The group of proteides has not received much study, but we must mention Malaguti's observation of the presence of sulphur in cystine (1837), and Piria's observation of the deamination of amino acids under the action of nitrous acid (1846).

Also worthy of note is the research on the ptomaines, which are produced by the putrefaction of proteid substances. Selmi, in 1872, was the first to enter this field, which received further study from the physiologist Angelo Mosso (1846-1910). Nor must we forget the work done by various scientists on hormones and melanin.

Biology and Zoology.—There are both importance and originality in the work of Giuseppe Levi (1872-), a teacher of anatomy at the University of Turin who has done research in cytology and histology. In 1933, Levi observed that, in cultures of the rhombencephalon of advanced embryos, after a few passages of a certain regularity in the wide space between the smear and the edge of the retracted coagulum, there appears a membrane made up of flattened epithelial cells and nerve cells, some of which maintain their atypical character and put forth multiple anastomosed feelers among themselves. This research on the part of Levi and his students was made possible by the Rockefeller Institute.

In the field of zoology, one of the pioneers of transformist theories was Filippo de Filippi (1814-1867), a professor at the University of Turin. During the first half of the 19th century systematic zoology flourished in Naples through the work of Gabriele Costa (1787-1867), who left behind him various works on the fauna of the region. His successor, Michele Lessona (1823-1894), a strong supporter of Charles Darwin, worked on the fauna of the Piedmont region. In 1874, Anton Dohrn (1840-1909) set up the Zoological Station of Naples, which was frequented by many scientists from abroad. Enrico Giglioli (1845-1909), a professor at the University of Florence, also contributed greatly to zoology with his monumental work, *Avifauna italica*.

Later came Carlo Emery (1848-1925) and Giovanni Battista Grassi (1854-1925). Emery was a student of Paolo Panceri (1833-1877), and was among the first Italians to base zoological research on new histological and anatomical techniques. He made a fundamental morphological chart of tetrapod mammals and accomplished a very interesting study of ants. Grassi, a professor at the University of Rome, took up Nematoda, leptocephalous Cestoda, and Phylloxera. He came to the conclusion that malaria is spread among human beings solely by the Anopheles mosquito, in which a life cycle of the malaria parasite takes place. In his work entitled *Studi di uno zoologo sulla malaria* (*A Zoologist Looks at Malaria*), he gave a biological description of the various forms of Plasmodia. This work and the method prescribed therein powerfully influenced all research on malaria for almost a half century afterwards. Among students of parasitology, we must mention Edoardo Perroncito (1847-1922), a professor at the University of Turin, known for his work on intestinal worms, and Corrado Parona (1848-1922), author of an important volume, *Elmintologia italiana* (*Italian Helminthology*).

Anatomy.—Several anatomists are worthy of note. Bartolomeo Panizza (1785-1867), a professor at the University of Pavia, is celebrated for his doctrines of cerebral localization and radicular ataxia. Filippo Pacini (1812-1883) was a pioneer in biological and histological research. Giulio Bizzozzero (1846-1907), a professor at the University of Turin, did inspiring work in histology and general pathology; he dis-

covered plastins and demonstrated the hematopoietic function of bone marrow. Camillo Golgi (1844–1926), a professor at the University of Pavia, was one of the most eminent scientists of the second half of the 19th century. His name is linked to the study of the structure of the nervous system and the Golgi reaction. Giuseppe Levi is the author of *Trattato di istologia* (*Treatise of Histology*, 1928), which has been translated into various languages. Besides making the cultures of tissues on slides described above, he discovered new details in the nuclei of nerve cells.

Botany.—Botany has been practiced as an experimental science in Italy since 1860, when the first institutes of research along this line were set up in the universities. Two schools of botany held sway during the following years, one Italian and the other German. The outstanding figure in the Italian school was Federico Delpino (1833–1905), who did fundamental work in plant biology. Meanwhile, the German school influenced the work of another Italian, Giuseppe Gibelli (1831–1898), and he had two able followers, Pietro Pirotta (1853–1936) and Oreste Mattioli (1856–1947), who taught in the universities of Rome and Turin, respectively. Pier Andrea Saccardo (1845–1920), noted for his fungological research, left a monumental work entitled *Sylloge fungorum omnium*, while his pupil, Giovanni Battista de Toni (1864–1924), worked on the algae. Among the cytologists we must recall Luigi Buscaglioni (1863–), who worked on histological technique for plants, and Sergio Tonzig (1905–), who did interesting work on the structure of protoplasm. Gabriele Luigi Montemartini (1869–) studied the fixation of atmospheric nitrogen on the part of certain saprophyte fungi with fallen leaves, while Gino Luigi Pollacci (1872–) covered the same process on the part of higher plants.

Physics.—Physics has always been brilliantly represented in Italy, even if an Alessandro Volta is not born every day. In the second half of the 19th century both teaching and laboratory research were on a high level. One of the most renowned physicists of the century was Augusto Righi (1850–1920), who made memorable experiments on electromagnetism, Hertzian waves, X-rays, and optics. His work on Hertzian waves was an incentive to Marchese Guglielmo Marconi (1874–1937) in his discovery of wireless telegraphy, one of the leading technical conquests of modern times.

The universities of Rome, Pisa, Bologna, and Florence, all of them endowed with up-to-date institutes of physics, furnished large numbers of teachers and research scientists to other universities and technical schools. Two names stand out in the second half of the 19th century: Antonio Pacinotti (1841–1912) and Galileo Ferraris (1847–1897). The former—son of Luigi Pacinotti (1810–1881), who taught experimental physics at the University of Pisa—was director of a modest laboratory of technical physics at the Normal School of Pisa. In 1858, he invented the Pacinotti ring, and in 1860, the “little machine,” or forerunner of the dynamo, which was imitated by Zénobe Théophile Gramme in 1872. Galileo Ferraris, a professor at the Museum of Industry and the Polytechnic Institute of Turin, was an eminent physicist and electrical engineer who discovered the rotary magnetic field. In his electrical studies, Ferraris upheld the impor-

tance of vectorial methods and demonstrated their usefulness in the exploration and representation of physical phenomena.

After the beginning of World War I, experimental physics entered a period of decay, due in part to the lack of adequate laboratories, and also to the small interest shown by students in the traditional subjects of research, most of which had already been undertaken in wealthier countries. The main fields seemed to have been thoroughly explored and all that was left to do, on condition of finding financial support, was to carry systematic research in them a little further. A new and fruitful period was opened, however, by a talented young scholar, Enrico Fermi (1901–), who developed a flourishing school in atomic physics. This school was broken up by the racial laws of 1938, which drove Fermi and some of his most gifted students into exile.

Fermi is internationally famous for his studies of the quantum theory and his pioneer research in molecular physics. In 1926, Fermi founded the statistical tables that bear his name, based on the study of the behavior of gases at a low temperature. He found a solution to his problem by applying to gases Pauli's exclusion principle, originally applied to internal quantum conditions.

After the discovery by Walther Bothe and H. Becker (1930) and Irène and Frédéric Joliot-Curie (1932) of artificial radioactivity, Fermi began research in Rome aimed at ascertaining whether a bombardment of neutrons would produce the same phenomena of radioactivity as those discovered by Joliot-Curie. Experiments carried out in collaboration with Franco Rasetti (1901–), Edoardo Amaldi (1908–), Oscar D'Agostino, Emilio Segrè (1905–), and B. Pontecorvo led in 1934 to the activation of some 40 heavy elements out of the more than 60 which were tested. Fermi and his collaborators discovered the slowing up of neutrons by means of paraffin, a phenomenon which is due to the presence of hydrogen. After the neutrons have for some time bombarded the nuclei of hydrogen, they give up their own vital force and move at a velocity the same as that of thermal agitation. By bombarding uranium with slow neutrons, Fermi obtained the two transuranium elements whose atomic numbers are 93 and 94, respectively. Further research on artificial radioactivity was done in 1936–1938 by M. Ageno, Gilberto Bernardini (1906–), D. Bocciarelli, Z. Ollano, G. P. Occhialini, C. Perrier, N. B. Cacciapuoti, and others, who made it possible to obtain radioactive isotopes of various elements. It is fitting to recall at this point the studies of cosmic rays begun in 1930 by Bruno Rossi (1905–) of the University of Padova, who eventually left Italy for racial reasons and taught at Cornell University.

The forced departure of Fermi, Rasetti, and others, as well as the growing attraction exercised on younger scholars by the immense possibilities of work in the United States, posed problems of great importance in the postwar period.

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9. ECONOMIC STRUCTURE AND PROBLEMS. The traveler in Italy, who is generally attracted by its natural and artistic beauties, historic places, and mild climate, seldom forms a

clear picture of economic conditions. Moreover, the main arteries of communication take him through the most active and prosperous sections of the country. He is therefore inclined to adopt the romantic and literary view, which only the vicissitudes of World War II to some degree corrected, that Italy, in spite of the burden of its history, is so favored by nature as to reap easily the benefits of modern technical progress. In reality, conditions vary so greatly even within a single region that highly contradictory conclusions may be formed. Striking contrasts may be found by anyone who travels from the orange-laden Conca d'Oro (Golden Bowl) surrounding Palermo to the nearby Sicilian hinterland; from the fertile Campanian country just back of Naples to Gaeta, in Latium; from the plains of Lombardy to the overhanging Alpine valleys; and from Genoa, Bologna, or Florence across the rugged Apennines. There are numerous other examples available to the conscientious observer of the Italian countryside, one of whose charms is its variety.

GENERAL FEATURES OF THE ITALIAN ECONOMY

Natural Resources.—The variety of the Italian economy stems first of all from environmental conditions. The climate, for instance, is characterized by unfavorable distribution and great irregularity of rainfall. Particularly in the south vegetation suffers from excessive rains in autumn and winter and drought during the balance of the year. This fact, coupled with a lack of irrigation, is an obstacle to intensive cultivation. Other limitations are caused by geological conformation: more than 40 per cent of the land is mountainous; only 20 per cent, plain. Moreover, the plains of the peninsula are crossed by narrow streams which are not generally useful for irrigation. The only exception is the Po River valley, one of the most productive sections of the country, which owes its development to hundreds of years of efforts to perfect irrigation and farming. Even here, however, the highest part of the valley and the Venetian plain which continues it have comparatively poor soil. The mountainous areas in many places allow for intensive cultivation of grapevines and olive and fruit trees, but the type of soil (generally sandy, clayey, or stony) does not facilitate agricultural development. (See also section on *The Land*.)

Another grave obstacle to a strong economy is the lack of minerals. In 1948, for example, Italian mines produced 974,000 metric tons of coal and 901,200 metric tons of lignite, while 8,302,291 tons of coal were imported. In 1938, 11,921,747 tons were imported. (During World War II, a maximum annual production of 2,305,200 tons of lignite and 2,520,000 tons of coal was achieved.) Lead and zinc are mined, particularly in Sardinia, as well as iron, iron pyrites, and mercury. Copper and other metals exist only in negligible quantities. Sulphur is abundant, but the mines operate under difficulties.

The Italian economy is also hampered by a lack of easy means of communication, particularly by river, and by the fact that the country is not situated on the main world trade routes. Finally, the country lacks the major raw materials essential to an industrial economy: rubber, cotton, wool, timber, cellulose, and oil. (There is, however, some natural gas, of which 108,200,000 cubic meters were produced in 1948. Promising discoveries were made near Piacenza in June 1949.)

These factors have restricted Italy in large part to agriculture, despite the unfavorable conditions of the terrain for intensive cultivation.

Population and Employment.—The scarcity of natural resources is accompanied by a very dense population, which increased from 23,617,153 in 1848 to an estimated 46,403,000 in 1948, or to an average of 399 persons per square mile. This is a high figure in an absolute sense, and it is even higher when we consider the available agricultural and forest land, of which only 52 per cent can be used for intensive cultivation. In a prevaingly agricultural country, this density of population retards the modernization of farming techniques and prevents the absorption on the land of a constantly increasing population. As a result, few more people were engaged in agriculture in 1949 than there had been 70 years before.

Of the 42,918,726 persons listed in the census of 1936, 18,345,432, or 42.7 per cent, were gainfully employed. The proportional distribution of the working population in 1936, as shown in Table I, remained substantially the same in the period following World War II.

Table I—EMPLOYMENT IN ITALY, 1936

Field	Number employed	Percentage of total	Percentage of independent workers in field
Agriculture, hunting, fishing.....	8,842,785	48.2	72.0
Industry, transportation.....	6,077,353	33.2	22.7
Commerce, banking, insurance.....	1,605,363	8.7	63.8
Professions and fine arts.....	142,958	.8	78.4
Public administration.....	808,866	4.4	..
Other.....	868,107	4.7	.1
Total.....	18,345,432	100.0	48.5

Italy's poverty in natural resources, a scarcity of savings available for capital investment, and the growing population are responsible for a sizable permanent unemployment. World War II aggravated this problem by causing extensive damage to plants and equipment and by increasing the number of women in factory employment. As of April 1949, there were 1,753,600 unemployed persons in Italy. (The number of persons on state and town relief rolls as of June 30, 1949, was 3,564,142.) In order to absorb all of them into the national economy, a capital investment of 4,000 billion lire¹ would be required. Moreover, it would be necessary for the world market to accept the resulting increased production, the greater part of which would have to be exported in order to pay for the required raw material imports. After World War II the Italian government endeavored, with United States aid, to alleviate the unemployment situation. The problem cannot be solved, however, without sizable emigration. (See section on *The People*.) There is also some hope of relieving the pressure of excess population by an international program of employment for Italian labor, and we must also note that the excess has been caused largely by a decline in the death rate (from an average of 19.1 per 1,000 in 1911-1915 to 10.6 per 1,000 in 1948). Moreover, in the same period the birth rate declined from an average of 31.5 per 1,000 to 21.5 per 1,000.

¹ In June 1949, 1 lira = 0.1739 cents in U.S. money; in November 1949, 0.1601 cents.

Development of the Italian Economy Since 1870.—Political factors have alternately arrested, stimulated, and altered the trend of production in Italy. The country did not attain final unity and political independence until 1870, and then only after a long and painful struggle against foreign and domestic enemies. Following unification, consolidation of the new government took precedence over economic development.

In 1870 the economy of Italy was overwhelmingly agricultural, and the scarcity of natural resources, lack of capital, high taxes, poverty of the great mass of the peasant class, lack (except in a few northern cities) of a commercial middle class prepared to organize bold new enterprises, and the inheritance of an antiquated social system from the various states into which the country had been divided, all these factors were responsible for a lag in industrial and general economic progress which required long years and much sacrifice to overcome. The critical circumstances under which the Italian nation was born are reflected in the lack of increase in agricultural production, in spite of an increase of population, and in emigration on a scale so large as to take on the character of an exodus, comparable only with that from Ireland (see Table 2).

Table 2—AGRICULTURAL PRODUCTION
AND EMIGRATION, 1876-1905

Years	Agricultural products per inhabitant ¹	Average annual emigration ²
1876-1880.....	...	108,600
1881-1885.....	100	153,400
1886-1890.....	93	221,600
1891-1895.....	89	256,400
1896-1900.....	91	310,400
1901-1905.....	111	553,200

¹ Index: 1881-85 = 100.

² Temporary and permanent.

This initial crisis, superimposed on adverse circumstances, greatly retarded industrial development. Domestic purchasing power was low, and the free-trade policy in force until 1887 opened the doors to long-established foreign products with which Italian handicraft enterprises and newly established factories could not hope to compete. The risks encountered by any new enterprise were great. Moreover, the abolition of internal customs duties among the former states of the peninsula had destroyed industries which had depended upon them for protection.

Nevertheless, the general political upheaval, the increase of travel and trade from one region of the country to another, the growth of population, and the greater frequency of contacts with other countries paved the way for an industrial

development which culminated in the years immediately preceding World War I. By 1898 production in all fields was increasing, and between 1898 and 1913 imports of raw materials increased by 70 per cent. The index of economic activity prepared by the economist Giorgio Mortara shows an equivalent rise for this period.

The economic trend from 1871 to 1913 is reflected in the changing character of Italian foreign trade, as shown in Table 3. By 1911-1913 imported foodstuffs and manufactured goods were proportionately in lesser demand than raw materials, and the export of manufactured products had taken precedence over that of food. In the same period, Italy's international exchange picture was transformed in another way. Until the end of the 19th century, Italy had an unfavorable balance of international payments, but thereafter tourist expenditures and emigrant remittances helped substantially to make up the deficit.

World War I and the ensuing political unrest had an important influence on the Italian economy. The harmonious development of the first decade of the 20th century was arrested, and only in 1923-1924 did national income regain the level of 1909-1913. Important changes took place in the industrial field. Before the war the textile industry (according to the census of 1911) employed a third of the country's industrial workers. As a result of the wartime demand for armaments, the group of industries in the mechanical field (machinery, motor vehicles, ships, aircraft, tools, motors, engines) took first place, and there was a corresponding increase in the industrial application of power. Between 1911 and 1927, the installed horsepower of nonelectric primary motors increased from 1,620,404 to 5,468,588; and that of electric motors in industry, from 586,161 to 2,642,860. The number of corporations increased from 2,189 in 1914 to over 4,000 in 1921, and between 1911 and 1921 the number of industrial workers went from 3,600,000 to more than 4,000,000. Unrest and the collapse of some insecure war industries lowered production in the immediate postwar period, but industrial development resumed thereafter, and by 1927 there were approximately 8,000 corporations with a capital investment (in lire at their 1913 value) twice as large as that of prewar corporate investment.

The economic crisis of 1929 had its effect on the Italian economy, which was further altered, particularly after the outbreak of the Italo-Ethiopian War in 1935, by the Fascist policy of autarchy, or economic self-sufficiency. This policy made free trade impossible and caused the emergence of new industries which could not have existed without government protection, thus stimulating an additional, though artificial, growth of industrialization. The deficit in the interna-

Table 3—DISTRIBUTION OF ITALIAN IMPORTS
AND EXPORTS, 1871-73 AND 1911-13

Type of goods	Percentage of imports		Percentage of exports		Index of shipments, 1911-13 *	
	1871-73	1911-13	1871-73	1911-13	Imports	Exports
Foodstuffs.....	26	20	44.0	30.3	329	184
Raw materials.....	30	38	17.5	14.5	557	222
Half-processed raw materials.....	14	19	26.5	24.1	580	244
Manufactured products.....	30	23	12.0	31.1	335	700
Total.....	100	100	100.0	100.0	433	268

* 1871-73 = 100.

tional balance of payments, which amounted to about 6 or 7 billion lire annually from 1922 to 1929, declined in the 1930's to approximately 3 billion lire annually (exclusive of colonial trade, which was distinctly favorable to metropolitan Italy). Imports of raw materials increased, both absolutely and relatively, compared with those of manufactured products, and there was a corresponding increase in the export of manufactured products. By 1938, the index of industrial production had risen to 243 (1922, the most inactive year of the immediate postwar period, = 100).

The direction of Italian industrial development from 1900 to 1939 is illustrated by Table 4,

Table 4—INDEX OF AVAILABLE INDUSTRIAL POWER
(Base, 1905-09 = 100)

1900-04	69
1905-09	100
1910-14	124
1915-19	116
1920-24	155
1925-29	201
1930-34	210
1935-39	260

which gives the index of available power, from all sources, for this period. This remarkable industrial progress was not matched by agricultural production, nor by the income of the average Italian, which is indicated by the average per capita daily consumption of calories (see Table 5).

Table 5—AGRICULTURAL PRODUCTION AND FOOD CONSUMPTION

Years	Average daily calories per capita	Agricultural production index *
1911-15	2,568	100
1916-20	2,596	101
1921-25	2,780	108
1926-30	2,883	112
1931-35	2,619	102
1936-40	2,652	103

* Base, 1911-15 = 100.

The damage inflicted by World War II on the Italian economy was enormous. Agricultural production in 1945 was only 60 per cent of that of 1938, and industrial production, which in 1945 was almost completely paralyzed, had in 1946 reached a level of only 65 per cent of that of 1938. The number of livestock had been reduced by 30 per cent, the railways were running at only 60 per cent efficiency, and only 15 per cent of the merchant marine had escape destruction. Buildings, both public and private, were extensively damaged. (Approximately 2,625,000 rooms were either destroyed or so badly damaged as to require rebuilding, and an additional 3,300,000 rooms suffered repairable damage.) Besides material losses and a consequent social upheaval, prices rose to more than 50 times their average prewar value (see Table 7, below), the tax system was disrupted, there was a large deficit in the national budget (in 1945-1946, this amounted to 357 billion lire), and there was an equally serious deficit in the balance of payments. It was very difficult to maintain even the minimum amount of food provided for in the rationing system, and the lack of raw materials forced many industries to dismiss their employees. This postwar crisis was overcome in large part by aid from the United States. Before the end of the war, the Allied armies had given various forms of aid.

This was succeeded by the work of the Allied Control Commission and, from March 1945, by that of the United Nations Relief and Rehabilitation Administration (UNRRA). By means of an aid agreement signed July 4, 1947, the United States distributed \$121,000,000 worth of supplies, and by the interim aid agreement of Jan. 3, 1948, an additional \$200,000,000. In all, from the beginning of 1947 to March 31, 1948, which marked the beginning of the European Recovery Program (ERP), \$820,000,000 worth of goods was given to Italy. To foodstuffs were added raw materials, thus enabling industry to resume production.

Meanwhile, the Italian government took an active part in the restoration of public services. Of the 22,955 kilometers of railways in service in 1939, 21,013 kilometers were in operation by 1948. By Jan. 1, 1949, the merchant marine totaled 2,275,272 tons, or about 67 per cent of the prewar figure. The roads, of which about 15,000 kilometers had been damaged, were restored to good condition, with the building of 3,300 bridges (of which 1,500 have a span greater than 10 meters), as well as tunnels, embankments, and repair shops. (Italy has a highway system totaling about 109,000 miles, including national, provincial, and local roads.) About 55 kilometers of harbor works were repaired, and 7,000 hospital rooms, 2,500 school rooms, and numerous other public buildings were rebuilt.

The arrest of Italian production, the exhaustion of reserves, and the necessity of importing large quantities of food created problems whose gravity is apparent from the figures, as estimated by the Bank of Italy, on the international balance of payments, which are shown in Table 6. The

Table 6—INTERNATIONAL BALANCE OF PAYMENTS, 1947 AND 1948
(active balance +; passive balance —)

Category	1947	1948
Goods (F.O.B.)	—\$661,300,000*	—\$320,400,000
Tourist trade	+ 6,400,000	+ 23,900,000
Freight and insurance	+ 181,000,000	+ 107,500,000
Income and investments	— 4,900,000	— 12,300,000
Government transactions	— 3,300,000	— 3,300,000
Emigrant remittances	+ 34,100,000	+ 84,900,000
Miscellaneous	+ 1,200,000	+ 62,000,000
Total deficit	—\$788,800,000	—\$272,700,000

* Including \$62,000,000 worth of surplus property sold in Italy.

deficits given for 1947 and 1948 may be compared with that of \$38,000,000 for 1938. This situation was met without a disastrous reduction of imports through United States aid. In 1948, exports amounted to \$1,067,600,000, and imports to \$1,388,000,000, exclusive of freight and insurance charges. Under ERP, designed to restore economic activity and to stimulate international trade, assignments to Italy through May 31, 1949, amounted to \$668,000,000, and paid exports to \$397,900,000. In the period from June 1948 to June 1949, ERP imports represented more than 25 per cent of the total of imported goods. The most important items were cereal products (more than 50 per cent of those imported), coal (50 per cent), petroleum products (62 per cent), and cotton (51 per cent). In addition, the United States lent Italy \$67,000,000. The counterpart fund built up in lire from the sale of ERP goods permitted Italy to undertake an extensive public works program, including rail-

roads, public buildings, shipping, and irrigation and reclamation projects, especially in the south.

Financial Factors.—In 1937, the lira was valued officially at 19 to the U.S. dollar; in 1943, the official exchange rate was set at 100 lire to the dollar. As inflation increased, the rate was raised, first to 225 (January 1946), and then to 350 (August 1947). Finally, in November 1947, the government exchange bureau was authorized to acquire 50 per cent of the foreign money derived from exports on the basis of the free market rate of the preceding month. The difference between the free and official rates declined, and in 1948 the exchange rate was stabilized at 575 lire to the U.S. dollar. Following the devaluation of the pound sterling in September 1949, the value of the lira declined; in November 1949 the rate was 624.5 to the dollar. For a comparison of monetary circulation, wholesale prices, and the cost of living in 1938, 1946, 1947, and 1948, see Table 7.

Table 7—MONETARY CIRCULATION, WHOLESALE PRICE INDEX, AND COST OF LIVING INDEX, 1938-48

Year	Circulation of lire (in billions) at year's end	Monetary circulation index	Wholesale price index	Cost of living index
1938.....	22.5	100	100	100
1946.....	512.7	2278	2884	2823
1947.....	795.0	3533	5159	4575
1948.....	970.0	4310	5443	4844

By 1949 the rise in prices had been checked. Imports and the gradual increase of domestic factory production enabled the Italian government to pursue a firm stabilization policy. Rationing was almost entirely eliminated, and the black market in commodities disappeared. The deficit in the national budget was reduced from 787 billion lire for the fiscal year 1947-1948 to 481 billion lire for 1948-1949, with an estimated deficit of 174 billion lire for 1949-1950. In spite of the high level of government expenditures (1,548 billion lire in 1947-1948, and an estimated 1,252 billion lire in 1948-1949) compared with a national income of approximately 5,400 billion lire (1948), there is a gradual but steady increase of government income. In 1947-1949, the monthly tax revenue rose from 50 billion lire to 80 billion lire. The government's stabilization policy also had the effect of increasing the proportion of the national income devoted to new savings and investments, which in 1948-1949 amounted to about 13 per cent, compared with about 10 per cent before World War II. Because of the low average income,² however, the volume of savings in Italy has never been large, but monetary stabilization was a strong incentive for the rebuilding of savings lost during the war.

In 1948, real national income was approximately 90 per cent of its 1938 level (84 per cent if allowance is made for the increase of population during the decade). In its report for 1947-1948, the Bank of Italy estimated the national income, in 1948 lire, at 6,000 billion lire in 1938, 5,050 billion lire in 1947, and 5,400 billion lire in 1948. The value of available goods and services

for 1948 is shown in Table 8, and their distribution in Table 9. The distribution of the 1,310,-

Table 8—VALUE OF AVAILABLE GOODS AND SERVICES, 1948

Category	Amount (in lire)
Net national income	5,400,000,000,000
Direct taxation	640,000,000,000
Amortization and maintenance	560,000,000,000
Imports	852,000,000,000
Total	7,452,000,000,000

Table 9—DISTRIBUTION OF AVAILABLE GOODS AND SERVICES, 1948

Category	Amount (in lire)
Internal consumption	5,525,000,000,000
Exports	617,000,000,000
Net investments	750,000,000,000
Amortization	560,000,000,000
Total	7,452,000,000,000

000,000,000 lire devoted to investment and amortization in 1948 is given in Table 10.

Table 10—DISTRIBUTION OF GROSS INVESTMENTS, 1948

Field	Amount (in lire)
Agriculture	160,000,000,000
Industry	460,000,000,000
Railroads	140,000,000,000
Communications	30,000,000,000
Motor vehicles	50,000,000,000
Merchant marine	60,000,000,000
Public works	260,000,000,000
Miscellaneous	50,000,000,000
Reserve	100,000,000,000
Total	1,310,000,000,000

INDUSTRY

Italian industry is characterized by a large number of small enterprises, sizable government participation, and great concentration in a number of important sectors.

General Features.—According to the 1937-1939 census of Italian industry, there were 1,022,539 active businesses with 4,373,652 employees, or an average of 4.2 per business. Of the total, however, 804,646 businesses were handicraft enterprises, and only 217,893 were industries in the technical sense of the word. The latter employed 3,154,394 persons (or an average of 14.5), of whom 2,809,730 were factory workers. Distribution of employees in the various fields of production is shown in Table 11. The difference

Table 11—INDUSTRIAL CENSUS, 1937-39

Industry	Employees (in thousands)	Factory workers (in thousands)	Added value of production (billions of lire)*	Horsepower (in thousands)
Mechanical.....	846.7	676.9	8.4	1,202.0
Textiles.....	628.5	573.7	4.9	869.2
Foodstuffs.....	574.5	361.7	5.2	948.2
Construction.....	558.5	480.6	2.4	159.1
Metallic minerals.....	206.8	175.9	1.0	389.0
Lumber, etc.....	283.6	130.9	1.0	210.0
Mining and quarrying.....	137.4	120.7	1.0	200.3
Chemicals.....	127.9	107.7	3.6	548.3
Clothing.....	308.7	105.1	0.9	30.3
Paper and printing.....	126.3	105.7	0.6	261.8
Metallurgical.....	103.6	94.3	2.1	984.0
Leather.....	215.5	77.2	0.9	66.1
Services and other.....	351.5	246.0	1.8	406.2
Total.....	4,469.5	3,256.4	33.8	6,274.5

* 1938 value.

between the totals given in the table and those of the 1936 census (see Table 1 and section on *The People*) is accounted for by the fact that

² Colin Clark in *The Economics of 1960* (New York 1942) gave the average annual income of an employed person in 1935-1938 as \$410 in Italy, \$804 in France, \$1,206 in the United Kingdom, and \$1,389 in the United States.

the census included domestic workers, workers in military service (of whom there were large numbers in 1936), and unemployed.

Excluding handicraft industries, 85.9 per cent of the business enterprises in the 1937-1939 census had less than 10 employees (14.4 per cent of the total number of employees); 10 per cent had from 11 to 50 employees (17.5 per cent of the total); 2 per cent had from 51 to 100 employees (11 per cent of the total); 1.8 per cent had from 101 to 500 employees (27.2 per cent of the total); 0.2 per cent had from 501 to 1,000 employees (11 per cent of the total); 0.1 per cent had 1,001 to 2,000 employees (9.6 per cent of the total); and only 87 enterprises had more than 2,000 employees (9.3 per cent of the total). Small and medium-sized enterprises prevail except in metallurgy, the production of electric power, and a few chemical products.

The prewar capital investment in industry was estimated at 110 billion lire (1938 value), of which two thirds was in corporations. In 1938 only nine corporations had a capital of more than 500,000,000 lire; they accounted for 21.6 per cent of all capital invested in corporations. In contrast, 96 per cent of the corporations had a capital of less than 10,000,000 lire; these comprised 20.75 per cent of the total corporate capital. Up to 1914 foreign capital was heavily invested in Italian industry. The amount of this capital declined after World War I, particularly after the Fascist government inaugurated its policy of autarchy, and just before World War II it amounted to 12 per cent of the corporate capital.

The Role of the Government.—The direct participation of the government and of governmental agencies in Italian industry is relatively large. The government began to play an important role at the time of the economic crisis of 1929, and its intervention in industry increased for political reasons in the period 1935-1940. This participation assumes four principal forms.

Government Administration.—The Italian government directly administers arms and munitions factories, naval shipyards, some chemical laboratories and mechanical enterprises, the mint, various mineral bath establishments, public works projects, and a few specialized plants, such as those devoted to the restoration of national monuments and to engraving.

Government Enterprises.—There are various autonomous agencies of the government, of which the chief is the Italian State Railways, controlling 73 per cent of the total railway mileage and large repair shops, and employing 200,000 persons. The next largest is the state monopoly of tobacco, salt, and quinine, with its farms, refineries, and laboratories. In addition, part of the telephone system is run by the government.

Government Ownership.—The role of the Italian government as a stockholder was developed during the Fascist regime. In this period the government acquired all or part of the stock of a number of companies which maintain a legal status of private ownership. Apart from the Istituto per la Ricostruzione Industriale (Istituto for Industrial Reconstruction, IRI), there are 30 such companies with a capital of 2,600 million lire (1938 value) and 30,000 employees. They include the Cogne Corporation, which is engaged in the mining of iron and coal and the production of iron and steel and employs 5,400 persons; the Azienda Generale Italiana Petroli (Italian General Oil Corporation, AGIP),

which refines, produces, and distributes petroleum and petroleum products; and the Azienda Nazionale Idrogenazione Combustibili (ANIC), owned by the government and the Montecatini Company, which produces gasoline and lubricating oils. AGIP and ANIC together have 7,000 employees. These two companies were instruments of the Fascist policy of autarchy in the field of fuel.

Public Corporations.—In addition to the foregoing, there are the semigovernmental enterprises, which, though publicly managed, are not part of the government proper. Chief among them is IRI, which owes its creation to a law of Jan. 23, 1933, designed to aid three large banks which had been affected by the depression of 1929. In 1949, the enterprises controlled by IRI had 234,900 employees and constituted the most important group of Italian industries. The distribution of this group among various fields of production is shown in Table 12.

Table 12—ISTITUTO PER LA RICOSTRUZIONE INDUSTRIALE

Field	Principal enterprises	Number of employees
Shipping.....	Finmare, a financial group controlling the four main Italian steamship companies.....	18,200
Mechanical.....	Shipyards (Ansaldo, Adriatico, OTO, Navalmeccanica) and others (Alfa Romeo, San Giorgio)....	101,200
Iron and steel.....	Ilva, Terni, Siac, Dalmine.	70,600
Electricity.....	SIP, SME, UNES, Terni..	7,400
Telephone.....	All lines in northern Italy..	8,500
Mineral.....	Monte Amiata.....	6,600
Chemical.....	Cellulose, synthetic rubber.	3,000
Land reclamation and other projects.	Sardinian, Maccarese, and Italstrade projects.....	19,400
Total.....		234,900

Scope of Government Intervention.—Government-controlled companies produce 85 per cent of Italian anthracite coal, 80 per cent of lignite, 65 per cent of mercury, 30 per cent of zinc, 15 per cent of lead, 80 per cent of pig iron, 65 per cent of steel, 80 per cent of ship construction, and 24 per cent of electric power. They manage 80 per cent of the telephone service, 40 per cent of all water transportation, and 73 per cent of the railway mileage.

Industrial Concentration.—Another aspect of the Italian industrial picture requires clarification if data on the prevalence of small and medium-sized enterprises is not to be subject to misinterpretation. This is the concentration of industry,

Table 13—CONCENTRATION OF ITALIAN INDUSTRY

Field	Number of large companies	Percentage of production controlled
Lead and zinc.....	6	92
Aluminum.....	3	95
Mercury.....	1	70
Coal.....	3	86
Pig iron and steel.....	6	84
Shipbuilding.....	3	97
Rubber.....	4	82
Caustic soda.....	4	90
Synthetic ammonia.....	2	86
Artificial textile fibers.....	2	90
Automobiles.....	2	84
Ball bearings.....	1	90
Matches.....	1	81

from both a technical and a financial standpoint, in a very few hands. Technical concentration is particularly pronounced in the mineral, iron and steel, electrical, and rubber industries, in shipbuilding, and in certain mechanical and chemical enterprises. The major examples of this concentration are shown in Table 13. Equally worthy of note is the concentration in the sugar, gas, and paper industries.

From a financial standpoint, besides the IRI group, described above, there is great concentration of capital in the production of electricity, the four major groups, which control 76.5 per cent of production, being connected with two large financial groups; and in the telephone service, largely controlled by IRI and two large private groups. Four industrial groups deserve special mention: (1) in chemicals, controlling 67 per cent of total production; (2) in the automotive industry, controlling 80 per cent; (3) in rubber, controlling about 70 per cent; and (4) in rayon, controlling 65 per cent. There are other large groups in the gas, coke, sugar, paper, and cement industries. In the textile industry there is far less concentration.

The total nominal capital of the enterprises listed above is about 200 billion lire (1949 value), compared with a nominal value of 337.8 billion lire for the 123 corporations listed by the Milan Stock Exchange.

In addition, there is a network of trusts, some of which were established by private interests and others through government action, all of them favored by protective tariffs. The most important are in the iron and steel and other metal industries.

After 1935, and to an even greater extent during World War II, many new organizations were created for the purpose of importing and distributing raw materials. The most important dealt with fuel. These excrescences, which may have been justified by an abnormal domestic market but which hindered healthy commercial development, were being abolished, slowly and with difficulty, after the war.

In general, although the larger groups have made sizable contributions to the development and renewal of productive equipment, the excessive concentration in the major sectors of Italian industry has had an unfavorable effect on the economy of the country.

Raw Materials.—We have seen that a scarcity of raw materials is a major characteristic of the Italian economy. Moreover, lack of capital and restriction of foreign trade have prevented the growth of plants processing imported supplies, such as are found in other countries equally poor in raw materials. One of Italian industry's most difficult problems has always been that of supply. The scope of this problem is shown by the following statistics for fuel, textile, metal, and other raw materials.

Fuel.—In Table 14 are given comparative figures of the amount of foreign and domestic coal, electric power, and petroleum consumed in Italy in 1926–1930, the period of maximum productive activity between World Wars I and II, and in 1936–1938, when the policy of autarchy prevailed. It is evident that in the second period a tremendous effort was made to achieve a certain independence from imported sources of power, but it is equally obvious that, despite drastic government intervention, this effort was not successful. After World War II, production

of electric power increased; in 1948, it amounted to approximately 22,692,000,000 kilowatt hours.

Table 14—SOURCES OF POWER, 1926–30 AND 1936–38

Source	1926–30		1936–38	
	Quantity*	Percentage of total calories	Quantity*	Percentage of total calories
Foreign coal..	13,310	84.3	11,441	71.1
Domestic coal..	1,031	4.3	1,991	8.2
Electric power..	8,503	6.2	14,628	10.4
Petroleum, gasoline and naphtha	609	5.2	1,258	10.3

* Coal and petroleum in thousands of metric tons; electric power in millions of kilowatt hours.

Textiles.—Cotton imports reached a high point of 220,000 metric tons in the period 1926–1930. The development of the manufacture of artificial textiles and limitations imposed upon the use of cotton reduced cotton imports to an average of 140,000 metric tons in the period 1935–1938. In 1948, 138,889 metric tons were imported. The reduction of cotton imports was made up by large imports of cellulose for the production of artificial fibers; these amounted to 145,429 metric tons in 1938, and 35,305 metric tons in 1948.

Wool, too, must be almost entirely imported. Italy received 60,763 metric tons of foreign wool in 1948. Among the less important textile fabrics, hemp is grown in sufficient quantity in Italy, but jute is almost entirely imported (25,427 metric tons in 1948). Domestic flax meets part of Italian requirements.

Metals.—In 1938, Italy imported 621,327 metric tons of iron and steel scrap, 69,878 metric tons of pig iron, and 184,268 metric tons of iron and steel products. Corresponding figures for 1948 were 122,722, 132,387, and 241,617 metric tons, respectively. Despite an increase in aluminum, lead, and zinc production in the decade before World War II, and measures taken by the government to limit the consumption of copper, this last especially has been imported in large quantities, amounting in 1938 to 80,612 metric tons (copper and copper alloys), and in 1948 to 70,874 metric tons. Nickel, tin, and antimony are also imported.

Other Raw Materials.—Other imported raw materials particularly necessary to Italian industry are rubber, wood, pulp, oilseeds, and phosphate rock.

Industrial Production.—By 1949 the industrial production index had recovered to approximately 95 per cent of the 1938 level. Production in the major fields of Italian industry is described below.

Metallurgy.—The iron and steel industry had before World War II reached a stage of development in keeping with domestic requirements, with a productive capacity of about 3,000,000 metric tons of steel and 1,500,000 metric tons of pig iron per year. In 1938, there were 19 blast furnaces, 5 of which were electric; 110 open-hearth furnaces; and 126 electric furnaces. About 84 per cent of production was concentrated in the plants of large combines. Many of the problems of a modern iron and steel industry have not been met; among other things, there is need for a reorganization of the plants producing steel plate.

In 1938, 928,800 metric tons of pig iron and ferroalloys and 2,328,000 metric tons of steel ingots and castings were produced. Corresponding figures for 1948 were 525,600 and 2,124,000 metric tons, respectively.

The manufacture of wire and nails is divided among a number of small companies. The same is true of secondary smelting plants, of which there are about 300, with 25,000 employees.

The aluminum industry, which grew considerably after World War I, is concentrated in four plants which process domestic bauxite and together have a capacity of 60,000 metric tons per year. From a maximum production of 48,195 metric tons in 1941, there was a decline to about 4,200 metric tons in 1945 and a rise to 33,000 metric tons in 1948. Increasing production depends upon the availability of cheap electric power.

The old-established lead and zinc industries, supplied from Sardinian mines, were extensively developed in the decade before World War II. There are three primary lead-smelting plants, with a capacity of 100,000 metric tons a year. In 1938, they produced 44,040 metric tons, and in 1948, 26,400 metric tons. The four Italian zinc plants have a capacity of 45,000 metric tons. Their maximum production (1940) was 39,360 metric tons; that of 1948, 26,630 metric tons.

Other branches of the metallurgical industry are unimportant if we except a few plants for the fabrication of imported copper and the production of mercury. In 1938, 2,027 metric tons of mercury were produced; in 1947, 1,861 metric tons.

The mining industry, except for the mines supplying the plants described above, was passing through a crisis after World War II, partly because its earlier prosperity had been bound up with the Fascist policy of autarchy. This was particularly true of coal, but applies equally to crude sulphur (380,345 metric tons in 1938, and 147,329 in 1947) and marble blocks (323,089 metric tons in 1938, and 263,646 in 1947). Production of iron ore amounted to 989,793 metric tons in 1938, and 454,300 in 1948; that of iron pyrites, to 930,312 metric tons in 1938, and 629,750 in 1947.

Industries in the Mechanical Field.—Together, the mechanical industries occupy first place in the Italian industrial picture, and chief among them is the manufacture of motor vehicles. In 1938, Italy produced about 52,000 passenger cars and 10,000 trucks; in 1948, 44,425 cars and 15,548 trucks and buses. In addition to the large automobile plants, there is a flourishing group of smaller body manufacturers whose craftsmanship is highly regarded in foreign countries. The production of bicycles and motorcycles increased after World War II, reaching 120 per cent of the 1938 level in 1947.

The manufacture of aircraft, which grew during the war until it numbered 150,000 employees, was in a process of reconversion after the war. In 1947, only 125 planes were produced.

There are 160 privately owned shipyards with 50,000 employees and a capacity (exclusive of wood bottoms) of about 200,000 gross tons per year. Even before World War II, their capacity was never fully exploited despite government subsidies. The four largest manufacturers of ship engines have a combined capacity of 500,000 horsepower-years in turbines and 300,000 horsepower-years in motors.

After World War II, the Italian railway machine shops were very busy replacing lost equipment. These shops, which are perhaps overly subdivided (there are 93, with 20,000 employees), have a combined capacity greater than that normally required by the Italian railways. Before the war they suffered from periodic difficulties, in which plants were shut down and the largest shops combined in order to secure export outlets.

The electromechanical industry is an active one, represented by four major firms, special departments in other mechanical industries, and numerous small and medium-sized plants. In all, they employ 70,000 workers. Widespread electrification has made for a large production of generators, transformers, motors, and all the equipment necessary to the production, distribution, and use of electric power. There has been an equal growth in the production of cables and conductors (17 plants with more than 5,000 employees), batteries, light bulbs (60,000,000 produced annually), and telephone material. The manufacture of precision tools also is prosperous.

Textiles.—The second largest Italian industry is that of textiles, with 6,000 factories and 600,000 employees, in addition to numerous small handicraft units. Textiles have been since the Middle Ages an Italian specialty, with silk enjoying a particularly long tradition. The chief textile centers are Prato, in Tuscany, and the regions around Milan, Biella, and Vicenza.

Silk manufacture is the most important and is supplied by the domestic output of cocoons, of which an estimated 9,000,000 were produced in 1948. Unfortunately, this industry declined noticeably after 1930. Many spinning establishments located near the mulberry groves closed down, but some plants specializing in the later processes of manufacture were modernized.

As silk declined, there was an increase in the manufacture of cotton cloth. Despite the destruction caused by World War II there were at the end of 1947, 5,301,663 spindles and 138,276 looms. The industry employs some 200,000 workers. The production of both yarn (200,000 metric tons) and cloth (in the best years, 900,000,000 meters) is larger than the domestic market can absorb. Both silk and cotton goods require an export market.

In spite of war damage the 1949 capacity of the wool industry was on a par with that of 1939. As of 1939, there were 1,162,244 spindles and 19,455 power looms. There are about 70,000 employees, of whom 20,000 produce yarn, 5,000 work in combing, 40,000 in weaving, and the remainder in various allied lines. Plant capacity totals 30,000 metric tons of yarn, 20,000 metric tons of combed wool, and 40,000 metric tons of cloth. In 1947, the mills produced 40,000 metric tons of wool tops, 32,000 metric tons of worsted yarns, 50,000 metric tons of woolen yarns, and 50,000 metric tons of wool fabrics. The spinning and combing plants are concentrated in a few hands, but the weaving industry is more generally divided except for the large combines in Valdarno and Schio, near Vicenza. The plants around Biella are medium to large in size, and those at Prato small to medium. The wool industry also exports a large part of its output, particularly finished goods.

The newer rayon industry grew rapidly during the period of autarchy. As of 1949, it had 36,000 employees, who worked in 80 plants, of

which 30 produced fiber. There are 130,000 spinnerette machines and 736,000 twisting spindles. A maximum production of 200,000 metric tons was attained in 1941. Production in 1949 was only 50 per cent of capacity.

The less important manufactures of hemp, flax, and jute together employ 40,000 workers.

Clothing is not big business in Italy. Of the 308,723 persons listed in the industrial census of 1937-1939, only 105,100 were factory workers. There are, however, some large establishments producing carpets, hats, elastic fabrics, underwear, and stockings.

Chemicals.—While the textile industry has been stabilized since 1930, the chemical industry has grown rapidly. As of 1949, it had 150,000 employees. Typical is the increase in the production of sulphuric acid, which went from 660,000 metric tons in 1914 to 777,000 in 1922, 1,127,000 in 1928, and 1,889,000 in 1938. A similar advance took place between 1928 and 1938 in almost all branches of the chemical industry. Production recovered rapidly after World War II, and by May 1949 it had reached 99 per cent of the 1938 level.

Foodstuffs.—The production of food is an important branch of Italian industry. According to the industrial census of 1937-1939, it employed 574,473 persons, of whom 361,700 were factory workers, the balance working in numerous small units. The census of 1937-1939 listed 292,906 individual plants, far more than the 168,451 in clothing. There are, however, some large firms. Among them are the 54 sugar refiners with 43,000 employees and a daily capacity of 7,000 metric tons. These were hard hit by World War II but by 1949 had regained their prewar level of more than 300,000 metric tons of sugar a year. There are also sizable firms producing candy, preserves, cheese, wine, beer, and spaghetti.

Lumber.—The lumber industry is divided among 123,162 units, and although some of them (such as the factories producing furniture and plywood) attain considerable size, most are classified as handicrafts. In 1947, Italy produced 3,693,110 cubic meters of timber.

Leather.—Of the 123,804 units listed by the industrial census of 1937-1939 for the tanning and leatherwork industry, only about 700 can be classified as industrial. Italian leather goods, noted for their high quality, supply the entire domestic market and are also exported.

Rubber.—Rubber is a large-scale industry in Italy. There are 269 producing units with approximately 40,000 employees. In 1948, 31,841 metric tons of crude rubber were imported. In addition, there is some production of synthetic rubber. Consumption has been increasing, and the industry recovered rapidly after World War II, reaching 120 per cent of 1938 production by May 1949.

Paper.—There is an old tradition of paper-making in Italy. According to the industrial census of 1937-1939, there were 1,992 producers with 56,127 employees. Newsprint is produced in a few large establishments. The production of paper increased from 350,000 metric tons in 1929 to 470,000 metric tons in 1938. Production in 1947 amounted to about two thirds of the prewar level. In general, the industry is hampered by high prices and a scarcity of pulp.

Construction.—Although the building trades occupied 558,544 persons according to the 1937-

1939 industrial census, there are few large companies. In the postwar period, high costs and rent controls combined to produce a crisis in the building industry despite government intervention to stimulate the repair of war damage and the undertaking of public housing projects. All necessary building materials are produced domestically. The production of building stone and brick is divided among a large number of companies, but the cement industry is concentrated in a few hands. Cement capacity, which totals 7,000,000 metric tons a year, is utilized only in part. In 1947, 2,943,000 metric tons were produced; in 1948, approximately 5,000,000 metric tons.

Electric Power.—There are 320 electric power companies and 1,091 central power plants belonging to the 11 major groups which control 85 per cent of the total installed power capacity. About 90 per cent of the plants are hydroelectric, and two thirds of them use water from the Alps. There are about 100 reservoirs and artificial lakes with a combined capacity of almost 2,000,000,000 cubic meters of water. By 1949, all the damage caused by World War II, which was particularly heavy in central and southern Italy, had been repaired and new facilities were under construction. The 1948 production of 22,692,000,000 kilowatt hours of electricity exceeded the previous maximum of 20,760,000,000 kilowatt hours attained in 1941. It was twice that of 1929, and considerably above the 15,800,000,000 kilowatt hours produced in 1938. Nevertheless, the supply of electric power has been unable to keep pace with the demands of Italian industry. Plans were under way in 1949 to increase facilities so as to produce 30,000,000,000 kilowatt hours of electricity annually by 1954.

AGRICULTURE

Crop Distribution.—Because local conditions are so varied in Italy, existing agricultural statistics cannot be classified so as to present a thorough conception of crop distribution. By resorting to extreme simplification, however, it is possible to give an approximate idea of land uses in the mountain, hill, and plain regions, as shown in Table 15. The percentages in this table are based on the pre-World War II total of agricultural and forest land, which amounted to approximately 28,500,000 hectares, or about 70,500,000 acres. (According to the 1947-1948 report of

Table 15.—PERCENTAGE DISTRIBUTION OF AGRICULTURAL AND FOREST LAND

Land Use	Mountainous	Hilly	Plain	All Italy
Cultivated.....	26	49	70	45
Orchards and olive groves.....	4	12	7	8
Permanent meadows...	5	2	6	4
Total cultivated area.....	35	63	83	57
Permanent meadows and grazing land (rotating).....	2	1	1	1
Permanent grazing land. Forests and chestnut groves.....	22	15	7	16
Uncultivated but productive.....	32	15	5	19
.....	9	6	4	7
Total, uncultivated area.....	65	37	17	43
Total.....	100	100	100	100

the National Institute of Agrarian Economy, the total area of agricultural and forest land is 68,730,291 acres.) This roughly indicated division must be supplemented by a description of local conditions.

First, we must distinguish between the Po Valley and the peninsula proper. In the great plain of the Po, agriculture is very different from what it is beyond the Apennines, in central and southern Italy—the characteristically Mediterranean region from Emilia to Sicily. Northern Italy produces large quantities of grain (wheat, corn, rice, rye, oats, barley), industrial plants (sugar beets, hemp, tomatoes), and fodder (irrigated single-crop meadowland or meadowland rotated with different kinds of clover). Central Italy and most of the south are characterized by grapes, almonds, citrus fruits, green vegetables, and large quantities of olives. Everywhere wheat is the largest crop, since it furnishes the bread and spaghetti which, with olive oil, form the staple diet of the rural Mediterranean population. Some wheat is grown on almost every Italian farm. In the north it is a soft wheat from which bread flour is ground; in the south it is hard wheat with a high gluten content that is particularly adapted to the production of the various kinds of spaghetti. This hard wheat is an invaluable source of protein for people who do not eat much meat. The widespread cultivation of wheat, then, is due in large part to the nourishment it guarantees a peasant family. Aside from this general north-south division, the chief agricultural zones of Italy are indicated in Table 16. The divisions are based on the total prewar area of Italy (76,649,080 acres).

Table 16—PRINCIPAL ITALIAN AGRICULTURAL ZONES

Zone	Approximate area in hectares
Mountains (Alps and Apennines)	11,000,000
Outer Alps and plateaus	3,100,000
Po Valley, irrigated	1,000,000
Po Valley, nonirrigated	2,000,000
Central Italy	4,500,000
Southern Italy and Sicily	6,800,000
Sardinia	2,400,000
Total	30,800,000

Mountains.—The Alpine portion of the mountainous zone is composed of forest and grazing land. The land under cultivation amounts to no more than 7 per cent of the total and is divided among a number of small farms. The forests and pastures are usually owned collectively or by municipalities. The typical mountain dweller lives in a house in a village (which is located as often as not in a valley) only during the winter months. The rest of the year he spends in the upland pastures. Stock raising is his chief means of livelihood, and his modest crop of wheat, rye, and potatoes does not supply all of his family's needs. The living standard is low, and the population is sparse.

The mountainous area of the Apennines, on the other hand, is cultivated. Here a typical agricultural economy prevails. A denser population and the nature of the terrain have overstimulated cultivation. Livestock consists of sheep rather than cattle, and in some areas the flocks are moved back and forth from winter to summer pastures.

The mountains of Italy have long since lost their original forest covering. Most of the existing forests are grown for periodic cutting, and only a third of the forest area consists of tall

trees. The most favored sections of the mountainous zone permit the cultivation of fruit, and there are many chestnut groves.

Outer Alps and Plateaus.—In this zone we find small farm units consisting of patches of cultivated land, pasture, an orchard or vineyard, and a small tract of woods. The fields of grain are planted with mulberry trees, which formerly stimulated the cultivation of silkworms. These farms produce comparatively little, and few head of livestock are raised.

In a category by themselves are the hilly regions of Langhe and Monferrato, where fruit trees and grapes are cultivated intensively in a fourth of the area.

Po Valley, Irrigated.—The irrigated portion of the Po Valley, by virtue of the terrain, water supply, large-scale irrigation projects, and intensive cultivation, makes up the richest agricultural zone of Italy. Here we find grains cultivated in rotation with meadowland, and in some places permanent meadows. Livestock is raised on a large scale, and some areas specialize in a single crop, notably rice. Individual returns are high, and considerable sums of money are invested in this zone.

Po Valley, Nonirrigated.—The nonirrigated portion of the Po Valley is somewhat less fertile than the irrigated portion, but it is still intensively cultivated. Industrial crops (hemp, sugar beets, tomatoes), together with orchards and vineyards, prevail. In some reclaimed areas there are large commercial farms. Here there is a serious labor problem because the employment of farm workers is seasonal.

Central Italy.—Agriculture in central Italy is characterized by the system of *mezzadria*, or cropping on half shares. The crops vary from one area to another. Olives prevail in one section; grapes (Chianti, Orvieto, Val di Pesa), in another. In addition, fruit, grain, and vegetables are cultivated, and there are areas of forest or fallow land. The coastal plains of Tuscany and Latium have benefited from reclamation projects and raise grain on a large scale.

Southern Italy and Sicily.—This agricultural zone is greatly handicapped by a scarcity of water. Olives, grain, and grapes prevail in various districts.

Along the coastal plains of Sicily and the Adriatic and Ionian seas, as well as in some dry sections of the interior, there are latifundia, or large private estates, which are devoted to the cultivation of grain and the raising of livestock. Around the towns, on the other hand, landholding is on a tiny scale. Neither extreme is very profitable. Only in some irrigated coastal areas is there intensive cultivation of citrus and other fruits, vegetables, and some industrial crops, such as hemp, tomatoes, and tobacco. Wherever the land is least fertile, we find olives and grapes.

Sardinia.—Sardinia is in a category of its own because so much of it consists of poor pasture, scrub forest, and fallow land. The population is not dense, and ownership of what little land can be intensively cultivated is widely distributed. Investments are small. In the more favored areas we find crops similar to those of the southern part of the peninsula, with grapes and olives predominating.

Production.—The principal agricultural products of Italy are shown in Table 17, which compares the output of 1936-1939 with that of 1948. It should be noted that the harvest of 1948 was

Table 17—PRINCIPAL ITALIAN AGRICULTURAL PRODUCTS, 1936-39 AND 1948

Principal crops	Average 1936-39 (metric tons)	1948 (metric tons)
Wheat.....	7,550,800	6,136,000
Corn.....	2,960,100	2,254,000
Rice.....	776,000	618,700
Oats.....	560,000	228,500
Potatoes.....	2,716,500	3,014,500
Tomatoes.....	952,200	962,600
Other vegetables.....	1,710,800	2,157,800
Sugar beets.....	3,271,500	3,408,500
Hemp fiber.....	109,700	76,800
Forage crops.....	30,447,700	29,833,500
Grapes.....	6,158,600	5,786,200
Olives.....	1,426,200	635,700
Oranges.....	325,500	352,900
Lemons.....	326,900	254,600
Other citrus fruit.....	85,100	84,400
Other fruit.....	1,567,800	1,573,200

distinctly better than those of 1945-1947. The olive crop, however, was exceptionally poor because of adverse weather conditions. Normal oil production is more than 200,000 metric tons; that of 1947 was 258,000 metric tons. In the same year, 31,858,000 hectoliters of wine were produced. These and all other items vary considerably from year to year, depending on climatic conditions. The average wheat production is 1.5 metric tons per hectare for the entire country, with a maximum of 2.5 to 3 metric tons in Lombardy and a minimum of less than 1 ton in Latium, the south, and the islands. More than half the grain produced in Italy comes from the Po Valley and Sicily.

In 1939, Italy had approximately 7,879,000 cattle, 3,303,000 swine, 9,875,000 sheep, and 1,867,000 goats. Livestock numbers were cut greatly during World War II, but these losses were largely replaced, and as of 1949 it was estimated that there were 7,500,000 cattle, 3,800,000 swine, 10,000,000 sheep and goats, 700,000 horses, and 700,000 donkeys and mules. The last two are found particularly in the south, while most of the other stocks are in the Po Valley.

Compared with its population, Italy's livestock resources are very small. In 1947, Italy had 161 head of cattle to every 1,000 inhabitants, in contrast to 371 for France, 217 for Germany (Bizone), and 552 for the United States. If the numbers of Italian livestock could be substantially increased, both the standard of living and agricultural exports could be raised, thereby providing funds for badly needed imports. In 1938, food products, particularly grain and fats, made up 14.1 per cent of total imports by value; and 35.5 per cent of total exports (citrus fruit, other fruit, vegetables, and wine). Corresponding figures for 1948 were 46.4 per cent and 20.4 per cent, respectively. It is essential that Italy increase its agricultural production and find additional foreign outlets for fruit and vegetables.

Land Distribution.—Approximately 40 per cent of the productive land of Italy is occupied by small one-family farms, far from any market, which produce only enough to meet the family needs. Even within this category, however, there are marked differences that require further explanation if we are to see how the land is actually distributed and how the farms are run. In the period following World War II, the distribution of the population engaged in agriculture remained approximately the same as it was at the time of the 1936 census (see Table 18).

Table 18—DISTRIBUTION OF POPULATION ENGAGED IN AGRICULTURE, 1936

Classification	Number	Percentage of total
Farmers cultivating their own land..	2,872,648	32.8
Lessees.....	788,340	9.0
Other types of farmers.....	74,766	0.8
Farmers with title to more than one farm.....	709,939	8.1
Sharecroppers.....	1,787,601	20.4
Persons who are both farmers and laborers.....	138,877	1.6
Managers.....	17,388	0.2
Day laborers.....	1,817,283	20.8
Laborers on yearly contracts.....	381,785	4.4
Cosharers and others.....	167,437	1.9
Total.....	8,756,064	100.0

Around the villages of the Alpine valleys there are small farms, composed of patches of fields, meadows, vineyards, and woodlands, whose owners have a communal arrangement for sharing grazing land and forests in the mountains. The same sort of farm, of more recent origin, is characteristic of the Outer Alps and plateau zone. It is very often run by its owner, but is sometimes leased or farmed on shares. This condition also prevails among the Piedmont hills.

The farms of the Po Valley are frequently run by a lessee who hires the necessary labor. Where the land is rich, the workers receive regular wages and a percentage of the produce. In the nonirrigated or recently reclaimed areas, the work is done by seasonally recruited day laborers. In the Lombard plain a large number of the workers are migrants who come for the season, particularly to the rice fields. The condition of the day laborers is unfavorable because of the seasonal character of their employment with long intervening periods of unemployment, and because of their enforced absence from their homes while they are working. Large and medium-sized properties are the rule, although some small farms are found on the edges of the Po plain.

In central Italy, where the system of *mezzadria* prevails, the farm unit is called the *podere* and usually has an area of 20 to 50 acres, or enough to be worked by one peasant family. Larger properties, especially in Umbria and Tuscany, consist of 5 to 20 *poderi* grouped together in one *fattoria*, which is under the direction of either the landowner or his manager. This system is adapted to the terrain, which is often unsuited to the use of agricultural machinery, and to the fact that a constant investment of money is necessary in order to show a profit. Except in some small mountain areas large and medium-sized properties prevail in central Italy.

From the Maremma southward to the end of the peninsula, large-scale properties are more numerous, particularly where grain or livestock is the major interest. Where cultivation is more intensive, properties are likely to be smaller, and even in the south there are small farms, particularly in the mountains. In the far south and Sicily farms are not laid out in single units; instead, pieces of land are leased and subleased to the peasants. Large tracts are often leased to a wealthy operator who hires the necessary day labor for longer or shorter periods. The limited arable area of Sardinia, on the other hand, is broken up into small, poor units.

According to the report of the National In-

stitute of Agrarian Economy given in Table 19, 77.5 per cent of the agricultural and forest land is the property of individuals. The land owned by the various private and public bodies has an economic value below what might be expected from its size, representing 10 per cent of taxable

Table 19—OWNERSHIP OF AGRICULTURAL AND FOREST LAND, REPORT OF THE NATIONAL INSTITUTE OF AGRARIAN ECONOMY, 1947-48

Class of ownership	Number of holdings	Area (in acres)
Individual.....	9,512,242	53,285,188.97
National government.....	3,000*	1,304,184.70
Provincial government.....	3,955	35,671.74
Municipal.....	23,869	8,661,489.72
Roman Catholic Church and other religious bodies.....	66,489	1,148,137.51
Commercial corporations.....	30,651	1,476,696.91
Welfare agencies.....	14,018	676,327.99
Peasant associations and other groups.....	23,990	2,142,594.09
Total.....	9,678,214	68,730,291.63

* Estimate.

farm income as against 22.5 per cent of the agricultural and forest land area. Of the 9,512,242 individually owned holdings, 53.96 per cent have a size of half a hectare (1.235 acres) or less (see Table 20). About 74.1 per cent of the area individually owned is in units of less than 100 hectares (247.1 acres), and 4.1 per cent in units of over 1,000 hectares (2,471 acres). On the other hand, of the land owned by private and public bodies, holdings of less than 100 hectares account for only 13.8 per cent of the total area of such land. Individual holdings of agricultural and forest land are distributed as shown in Table 20. These figures, which apply to Italy as a

Table 20—DISTRIBUTION OF INDIVIDUALLY OWNED AGRICULTURAL AND FOREST LAND, 1947-48

Classification by hectares	Number of holdings	Percentage of total	Area (in hectares)	Percentage of total area
Up to 0.5.....	5,132,851	53.96	875,000	4.1
0.5-2.....	2,795,122	29.38	2,883,000	13.4
2-5.....	950,070	9.99	2,943,300	13.6
5-10.....	330,733	3.48	2,289,700	10.6
10-25.....	192,815	2.03	2,945,500	13.6
25-50.....	60,874	0.64	2,104,400	9.7
50-100.....	28,381	0.29	1,956,400	9.1
100-200.....	12,918	0.14	1,782,100	8.3
200-500.....	6,536	0.07	1,946,600	9.0
500-1,000.....	1,440	0.02	971,200	4.5
Over 1,000.....	502	0.00	875,700	4.1
Total.....	9,512,242	100.00	21,572,900	100.0

whole, are supplemented by statistics on taxable income divided by major agricultural regions (Table 21). Because of great variations in land productivity, taxable income is a more meaningful criterion of land distribution than area is. We learn from this data that the least valuable properties are found in greatest numbers in the mountains and in Liguria, the small- to medium-value properties in the northern hills and in Sardinia, the medium-value ones in the center and south and in Sicily, and the medium- to large-value ones in the Po Valley.

With regard to the land owned by public and private bodies, as shown in Table 19, 56.1 per cent of the total of such land belongs to municipalities, 9.6 per cent to commercial corporations, 8.7 per cent to the national and provincial gov-

Table 21—PERCENTAGE DISTRIBUTION OF TAXABLE INCOME, AGRICULTURAL AND FOREST LANDS, 1947-48

Zone	Taxable income, based on assessments as of Jan. 1, 1943, in lire at their 1938 value			
	To 1,000	1,000-10,000	10,000-100,000	Over 100,000
Alps.....	63.2	31.1	5.6	0.1
Liguria.....	57.7	36.9	5.4	0.0
Northern hills.....	27.9	47.1	21.8	3.2
Po Valley.....	6.7	28.9	47.5	16.9
Central.....	13.9	36.9	36.6	12.6
Apennines.....	39.7	39.0	17.7	3.6
Southern.....	28.6	36.2	26.5	8.7
Sicily.....	25.3	36.3	28.7	9.7
Sardinia.....	38.9	47.7	13.1	0.3
Total.....	22.0	36.2	31.8	10.0

ernments, 7.4 per cent to the Roman Catholic Church and other religious bodies, 4.4 per cent to welfare organizations, and the balance (13.8 per cent) to peasant associations and other groups. Commercial ownership is found especially in the plains; communal ownership, in the mountains. Organizational ownership is most important in Trento, Latium, Umbria, Lombardy, and Tuscany.

Agricultural Problems.—The major problem of Italian agriculture after World War II was the return to normal production. Although this goal was well on the way to realization by 1949, there remained the problem of raising production above prewar levels in order to take care of the increased population and improve the average standard of food consumption.

A second group of problems is related to the necessity of adapting production to market conditions. During the Fascist regime, Italian agriculture aimed at national self-sufficiency and the extension of the acreage devoted to the cultivation of grain. Some of the circumstances that determined this policy—the difficulty of securing certain foreign supplies and of exporting fresh fruit, vegetables, and wine—still obtained after the war. Nevertheless, for Italian agriculture to prosper there must be freedom to concentrate on improving and increasing those types of cultivation to which soil and terrain are best suited, and to place the products of this cultivation on a free world market.

The large number of small holdings, the existence of a large class of farm laborers, and lack of capital make technical improvement difficult. There is much to be done in the development of professional instruction, in the provision of easier farm credit, and, eventually, in organizing cooperatives for the use of agricultural machinery and the processing and sale of farm products.

In addition to these technical problems, there are two social problems: overpopulation in certain areas, and the existence of approximately 2,000,000 farm laborers who have no economic security. The first, as explained above, is a general problem of the Italian economy, and its solution would require a number of long-range measures, such as greater emigration, emphasis on different types of crops, and further industrial development supported by new capital.

The problem of the *braccianti*, or laborer, is closely connected with overpopulation and with land distribution and farming methods. The

term *bracciante* includes both those whose work is seasonal and those whose wages are uncertain. There are, however, many different types of laborer. There is, for example, a tremendous difference between the employees of a large commercial farm of the Po Valley and the peasants of a large southern estate. In both cases, however, it is not sufficient to increase the amount of goods that the laborer can acquire with his wages. There is need also for some form of contract, whether tenancy or *mezzadria*, by virtue of which the farm worker can feel some ownership or at least participation, and also certainty of employment. For large masses of the rural population, that is the only way to achieve a better life. As conditions have existed, the peasant in some areas is caught in a vicious circle of poverty. The laborer in Apulia, for instance, has no share in what he produces and does his work slackly and reluctantly. Much energy is wasted because of the lack of incentive or any real connection with the land. Such conditions were responsible, for example, for the strike of about 1,000,000 farmhands in the Po Valley and central Italy in the spring of 1949.

Even when a peasant has saved enough money to buy his own farm, in those regions where large holdings prevail there has been no land on the market for him to purchase. For this reason, proposals for agrarian reform have long been made. As a matter of fact, agrarian reform has been under way for centuries, with the steady increase of small holdings and intensive cultivation. There are two chief aspects to the problem. First, there must be a change from extensive to intensive cultivation in certain areas, and, second, in areas where large holdings monopolize the land they must be broken up. In addition, the efficiency of the smallest type of landholding must be increased, and fairer leasing and sharecropping arrangements must be made where a further increase in the number of holdings is impractical.

Only in a part of central and southern Italy is there need for forced redistribution of the land. In many areas such parceling would reduce productivity. In a proposal made by the Italian government in April 1949, it was suggested that the excess land of extensively cultivated properties yielding a taxable income of more than 40,000 or 50,000 lire (1938 value), and intensively cultivated properties yielding more than 60,000 lire, based on assessments as of Jan. 1, 1943, be sold for redistribution over a specified period. Any such land remaining unsold would then be expropriated, its owners receiving compensation. It was expected that this plan would make available a minimum of 3,000,000 acres for redistribution.

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10. POLITICAL AND ADMINISTRATIVE STRUCTURE. The study of Italian political problems and the description of Italy's constitutional and administrative structure fall properly into three main chronological subdivisions: (1) Italy under the Constitution of 1848, and until 1922, when the Fascists seized power; (2) the Fascist interlude, from 1922 to 1943; and (3) the period from the downfall of fascism in 1943 to the establishment of the Italian Republic in 1946 and the framing of a new constitution in 1947.

LIBERAL ITALY UNDER THE CONSTITUTION OF 1848

The Constitution of 1848, granted originally to the people of the Kingdom of Sardinia by Charles Albert (q.v.), became the constitution of the Kingdom of Italy upon its formation in March 1861, and was later extended to the entire peninsula as the process of unification proceeded. While the framers of the constitution had in mind the creation of a system of government in which the powers of the king would be quite broad and independent of Parliament, custom and the influence of the English system gradually led to the development of a parliamentary regime. The shift in emphasis from king to Parliament was achieved rather early. Indeed, the principle of the supremacy of Parliament, and of the primary responsibility of the government to Parliament, was already firmly established by the time of the death of the great builder of Italian unity, Camillo Benso di Cavour (q.v.), in June 1861.

Considering, then, the Italian system of government from 1861 to 1922 as a parliamentary monarchy, we can observe the following fundamental characteristics:

The Monarchy.—In general, the three rulers of this period—Victor Emmanuel II, Humbert I, and, until October 1922, Victor Emmanuel III (qq.v.)—behaved as expected of constitutional monarchs. Their task was to reign and not to rule, to keep wholly outside of politics, and to accept as mandatory whatever political move was dictated by the parliamentary majority of the moment.

Parliament.—Two houses existed throughout this period—a lower house, the Chamber of De-

puties, and an upper house, the Senate. The suffrage was not extended to all adult males (with the exception of illiterates under 30 years of age) until 1912, so that for the first half century the Chamber of Deputies was elected on a relatively narrow, though constantly widening, basis. (All literacy requirements for voting were finally abolished in 1919.) Senators were appointed for life by the king, upon recommendation of the prime minister. Effective political power belonged to the Chamber of Deputies; all cabinets had to seek its confidence and could be overthrown by it. The Senate's role was one of advice and, presumably, of debate of fundamental issues on a higher level.

Until 1919 the electoral laws were based on single-deputy constituencies. This meant the establishment of strong personal relationships between political candidates and the electors. The local ties, the family background, the personal views of a deputy mattered a good deal more than his membership in one or another political party. Italian political life at this period thus bears a strong resemblance to that of France, personal issues and attitudes being more significant than any steady attachment to rigid political programs. This was the era of transformism (see section on *History*), and to some critics of Italian politics the word bears vituperative connotations. It was, to be sure, a system which made for blurred party lines, and for insecure governments, because no government could count on the allegiance of well-disciplined ranks of supporting parties. Nevertheless, the system brought into political life a human touch and a sense of political realities which are missing when Parliament is rigidly aligned among great parties whose members have been reduced to the status of robots. The parliamentary history of this period, therefore, is known not through the vicissitudes of political parties but through those of political leaders, as they succeeded or failed in retaining a following sufficient to keep them in power. This is especially true of the period after 1876, when the Right was driven from office. The outstanding name of this period is that of Giovanni Giolitti, who served five terms of office as prime minister and knew better than anyone else how to manipulate parliamentary majorities with a cleverness which, while not contributing to the raising of the level of political morality, helped to maintain effective government.

After 1919, the political scene changed. The major cause was the war; the contributing cause, the revision of the electoral machinery. In Italy, as in most countries, World War I precipitated political developments whose formation would otherwise have proceeded at a much slower pace. Two of these developments were of major proportions, and such as to change the complexion of Parliament. The first was the birth of a full-fledged Christian Democratic movement; the second, the great increase in strength of the Socialist Party.

The appearance of Christian democracy, if sudden and dramatic, was not unforeseen. For several decades, the political, economic, and organizing activities of groups calling themselves Christian Democrats had been increasing. By the end of World War I it was apparent that the only factor withholding this movement from a public appearance on the political stage was the Vatican's veto against the participation of Catholics in the political life of the country. This

veto had gradually been softened to permit participation in local politics, but up to 1919 no national Catholic party could have been organized. When, during the war, the pope made it clear that the church, far from desiring the political destruction of Italy, favored the strengthening of the country and implied that the Roman question (see section on *History*) no longer had any real significance from a territorial point of view, the end was in sight. The dam was broken when the pope let it be known that he would not object to Catholics standing for office. In January 1919, the Italian Popular Party was formed. It won 101 seats in the election of 1919 and 108 in the election of 1921, becoming the second most important political party in the Chamber of Deputies.

The strongest was the Socialist Party. As a party it was committed to a revolutionary program and could, therefore, admit no compromise that entailed any degree of collaboration with the existing political regime, constitutionally a monarchy and politically bourgeois. The revolutionary climax seemed at hand in September 1920, when, under Socialist leadership, workers occupied the largest industrial factories. There was no resistance, and the bourgeois state seemed to be collapsing. As the barricades were being manned, the Socialist leaders suddenly discovered that there was no Lenin or Trotsky among them and that they had retained bourgeois ideas under their revolutionary appearance. The call to the barricades was off, the factories were surrendered, and the revolution was postponed indefinitely.

This was the essence of the crisis which weakened postwar Italian socialism: an official revolutionary attitude coupled with an innate incapacity for revolution. In 1919, and again in 1921, the Socialists, as the largest political group, could have formed a Cabinet, but they took the position that they could never participate in any government. This position, logical if we consider the revolutionary premises of the party, became political suicide for a party incapable of revolution and led to a serious weakening of parliamentary government.

The changed political outlook was accompanied by a change in the electoral machinery, from a single constituency system to proportional representation applied within fairly large constituencies. The chief consequence of this development was the strengthening of organized political party life—a good thing in itself, provided normal relationships could be established among the parties. As it was, the Socialists cut themselves off as a result of their rigid and preconceived position, the Christian Democrats were viewed with suspicion by the liberal and democratic groups imbued with the old lay tradition, while these groups were themselves incapable of providing strong government and of renovating their outworn political leadership.

Administrative System.—The general pattern consistently followed by Italy since her unification has been one of centralization based largely on the Napoleonic system. As Piedmont gradually extended its control over the whole country, it imposed a uniform system of administration which failed to take into account the regional differences of the past. The country was ruled from the center and divided into provinces, each headed by a prefect appointed by the central government. There is nothing wrong with a centralized administrative system in so small a

country as Italy, provided certain limitations are recognized beyond which the power of the central government generally does not extend. In Italy these limitations were not recognized, and the development of democratic institutions at the periphery was thwarted. Nevertheless, Italian bureaucracy, though all-embracing and rigid and not very up to date in its methods, developed into a good administrative machine with high standards of honesty and devotion to the ideals of public service. Only fascism succeeded in corrupting it. Similar limitations hampered the judiciary, which had to move within the stiff framework provided by a system of codified law, with no room for imagination and feeling for social change on the part of the judges.

Local governments were independent in name. Each province had an elective provincial council with limited jurisdiction. Each commune, or town, was governed by an elective municipal council. But over them all hovered the omnipotent figure of the prefect. Stifled and controlled at every turn, local administrators could hardly be expected to develop independent plans and the proud spirit which has made of the institution of local self-government a pillar of strength of democratic traditions in Anglo-Saxon countries. But the power of control was not the only one which the central government could exercise through the prefects. It could, and repeatedly did, dissolve popularly elected municipal councils and replace elected mayors with central government commissioners. Such drastic moves had to be justified by a substantial degree of administrative malfeasance on the part of the local bodies. While malfeasance existed in some instances, it was invented in others, when the primary purpose was the removal of recalcitrant local political leaders whose activities were deemed a nuisance to the political groups in power in Rome. It is important to establish as a historical fact that even before 1922 the weakening of local democratic institutions had begun as the result of a belief in the superiority of a centralized administrative system.

Political Freedoms.—Notwithstanding these shortcomings, the historical balance must weigh heavily in favor of the conclusion that, in the period under consideration, personal and political liberties were greatly strengthened. The citizen remained secure in his fundamental rights, even though suffering at times from an excess of police zeal in the maintenance of law and order; and voting could be freely exercised by all except in some areas of southern Italy where ignorance and political pressure combined to produce unsatisfactory results. Above all, that fundamental and first of political freedoms, freedom of the press, was in full bloom and vivified political life with its presence.

It has become increasingly difficult to define the conditions which are required for the existence of a free press. For our purposes, it is perhaps enough to say that freedom of the press exists in any country which has a certain minimum number of independent newspapers. An independent newspaper is one whose policies are established by a board of editors which is free of ties with any political party, group, or particular economic interest, and is entirely devoted to the promotion of the public welfare. Such a newspaper must have achieved, because of its independent criticism of policies and of views, because of its full and objective coverage of news as dis-

tinguished from opinion, because of the good quality of its writing, a wide circulation and must be available to all throughout the country. A country which is blessed by two or three newspapers of this type has come as near to the ideal of freedom of the press as it is human to expect. Italy, together with a very few other countries, found herself in this condition during the first quarter of the 20th century. An informed public opinion, educated by a strong press, was one of the greatest obstacles fascism had to surmount before it could achieve its dictatorial goal. This was attainable only after the use of violence, legal or otherwise, had allowed fascism to gain complete physical control of the Italian press.

Economic Policies.—This period was one of great economic development. Old industries, such as the manufacture of textiles, expanded, while new industries, such as iron, steel, and engineering, were created. Not all of this growth was achieved without government intervention and protection, including the use of subsidies and protective tariffs. Such aid brought about the rise to influence of a group of industrialists who could not justify their existence except as representatives of the state, and the development of labor groups which considered it logical to thrive on government privileges. This artificial economic structure helped to aggravate the 1919 crisis and led some industrial leaders to consider the state as their own preserve, which they could use for the satisfaction of their private interests.

THE FASCIST CRISIS

Many reasons have been given to explain the development of a strong Fascist movement in Italy after the autumn of 1920, and the seizure of power by that movement on Oct. 28, 1922. The least valid of the explanations seems to be the purely Marxist one, which sees everything in terms of a struggle between a declining but aggressive capitalist system and the proletariat, with the triumphant capitalists establishing a dictatorship to keep the working class under their control. The reality is far more complex. Sentimental and entirely uneconomic nationalistic feelings played a major role. Traditions which made the maintenance of law and order appear desirable as a matter of principle have also to be taken into account. From our point of view, however, it is sufficient to point out the failure of the political system, and specifically of Parliament, to function in times of crisis. Any inquiry into historical might-have-beens is usually unrewarding. The fact is that among the elder statesmen who in 1922 held the balance of power there was a widespread sentiment of resignation and of self-admitted failure. Under the circumstances, they reasoned, the only way out of the political crisis was to let the new Fascist movement assume the responsibility of government and show what it could do. The twin hope was never abandoned that, on the one hand, once in power fascism would become a normal and constitutional political movement and that, on the other, it would gradually decline and allow the older political groups to return to office. Both hopes were inevitably destined to be disappointed, and fascism developed as a ruthless totalitarian dictatorship, unconstitutional by definition, which completely abolished all non-Fascist political leadership.

Fascism and Government.—The apex of the Fascist system was the dictator, who enjoyed all

the extraordinary legal powers granted to him by special laws and the even wider sphere of illegal and personal powers possessed by the leader in any dictatorial system. Benito Mussolini's power remained quite strong almost to the end. His influence reached down into the administrative sphere, and no policies could be adopted without his sanction. His influence was also used to symbolize the new Italy fascism was said to be developing and to create that leader-and-follower complex which is the essence of such a system. To him was attributed an all-encompassing wisdom and knowledge, and an attempt was made to train the people to accept all his decisions as indisputably right.

Next to the dictator was the *Gran Consiglio del Fascismo* (Fascist Grand Council), which was made an organ of the state in 1928. It was the highest assembly in which the top leadership of the Fascist Party could act as a corporate body. What the actual accomplishments of this agency were, in terms of establishing general policy directives is difficult to say in the absence of any exhaustive published record of its activities. Great mystery surrounded its meetings, which were usually held late at night. It is likely, however, that within it the various currents of fascism found expression and tried to gain ascendancy by influencing Mussolini. This was a fruitless process, since he was easily accessible to successive and contradictory views. By 1943, fierce conflicts had arisen within the council, with a large group revolting against the leadership of the dictator.

Next in order, but actually at the bottom of the scale in point of influence, came Parliament in the various stages of its transformation under fascism. As a result of the elections of 1924, a Fascist-dominated Chamber of Deputies came into existence, bearing, however, some outward resemblance to the chambers of the past, owing to the existence of an effective opposition, whose chief leader was the United Socialist deputy Giacomo Matteotti. Matteotti's murder on June 10, 1924, marks the beginning of a complete totalitarian regime. The Chamber of 1929 was the first elected by plebiscite (from an official slate by a sharply reduced electorate), and was composed solely of Fascists. The Chamber of 1935 represented the first fruit of the corporative phase of fascism, for all its members were representatives of organized economic groups. In 1938, the Chamber of Deputies was abolished and replaced by the Chamber of Fasces and Corporations.

Throughout these vicissitudes the organization of the Senate remained unchanged. Its members continued to be appointed by the king, though of course from among deserving Fascists recommended by the government. To the end, however, a small group of pre-Fascist senators continued to exercise their functions. In the last decade of fascism, they remained silent of necessity, but a few black balls continued to mar the principle of unanimity deemed so important by the official doctrine. As parliamentary bodies, both Chamber and Senate were reduced to the task of recording decisions taken by the higher party hierarchy.

Fascism and Administration.—In its attitude toward the civil service, fascism followed a policy of expediency, compounded of cynicism and the realization that it needed the daily support of hundreds of thousands of public employees working at routine tasks. A few were discharged.

The majority seized upon the first suitable occasion to join the Fascist Party. Among the higher ranks of civil servants, judges, and university professors, those who refused to join the party were more numerous. In 1931, all civil servants were required to take an oath of allegiance to the regime, which most of them did take after Benedetto Croce pointed out the invalidity of such an oath. Those who refused to take the oath were dismissed, but party membership was not made compulsory on civil servants who had acquired permanent tenure. Naturally, promotions and transfers to more desirable jobs and locations were out of the question for nonmembers. As the years of Fascist rule wore on, a new generation of younger and Fascist appointees occupied a majority of the administrative posts, while at the same time the functions of government were greatly expanded. As a whole, the competence and the high regard for the public weal which had obtained in the past were seriously weakened.

In the field of local administration, fascism developed logically its premise that authority flows from above, and that elections of all kinds should be abolished, by eliminating all traces of self-government and replacing local elective mayors with centrally appointed officials.

Fascism and Political Freedom.—The basic element of political freedom, the possibility for the citizen to choose between different courses of action, disappeared. A monopoly of political power was in the hands of the Fascist Party. Within this framework, all other freedoms disappeared. Freedom of association was suppressed. All groups had to receive the government's stamp of approval. Freedom of assembly and freedom of speech were similarly limited. Freedom of the press continued to exist only within the framework of the interests of the ruling ideology. The courageous resistance of the great majority of non-Fascist papers was finally overcome in 1925. In that year, a law was passed which required each newspaper to accept a government-appointed director. Thereafter, only Fascist papers existed, distinguished among themselves only by the degree of virulence in their vocabulary and by the degree of proximity to the treasury of the Fascist Party (some of them had to be financed outright by the party, while others bearing old and famous names continued to be financially self-supporting). Their make-up, headlines, and general distribution of contents were regulated by a central propaganda office in Rome. There was no old-fashioned censorship: no modern dictator could stand the sight of newspapers appearing with large blank spaces on the front page. By far the most effective method was that of decreeing every day what the papers should print.

Fascism and Economic Life.—Having destroyed civil liberties, fascism could not maintain freedom in the economic sphere. The system of regulation which began in 1926 with the establishment of syndicates, as the monopolistic Fascist trade unions were called, was extended gradually to all spheres of economic life. The Fascist economic controls sprang both from a desire for regulating people's lives and from the logic of a political system which very soon made war its final goal. When, during the depression of the early 1930's, fascism gained control of a sizable portion of the industry and the banking structure of Italy, the element of chance was still very

great. After 1935, however, the extension of government controls became a deliberate policy. These were the years when the corporative system was put into effect and was hailed by Fascist apologists as an epoch-making discovery, giving economic life its due in a world accustomed for too long to recognize the primacy of political values. But the corporative system was nothing but a screen hiding the much simpler reality of mobilization for aggressive war.

Fascism and the People.—There were three major phases in the relation of the Italian people to fascism. The first was the long and generally unrecognized period of resistance which extended from 1920 to 1926. This was a time of warfare in which substantial numbers of people actively participated. The costly fight was unavailing. The second phase lasted from 1926 to 1936. It was a period of resignation and of open allegiance on the part of many who were satisfied by the limited economic improvement which then took place. This was a time when opposition to fascism seemed the attitude of Utopian dreamers who failed to notice the worldwide chorus of approval for the system. The third phase extended from 1936 to 1943. The Ethiopian War (1935-1936) brought home to many the realization of what fascism meant. Extensive underground activities began, and free Italy matched the Fascist intervention in Spain in support of Gen. Francisco Franco with an anti-Fascist intervention of thousands of courageous fighters in defense of democratic institutions. The name of Carlo Rosselli, publisher of an anti-Fascist Italian weekly in France, should be remembered at this point. It was because he symbolized the new Italy which was being born that Mussolini had him murdered in France in 1937 together with his brother Nello. With the beginning of World War II, anti-Fascist activities became more intense and new and old party lines began to be drawn. In the spring of 1943, strikes and other openly rebellious movements took place, and, under the joint impact of British and American invasion and popular revolt, fascism quickly disintegrated. It was obvious that it had long since ceased to command the allegiance of the great majority of the Italian people, who were slowly and confusedly groping their way toward some new kind of political organization. This is not to say that 21 years of Fascist rule could go by without leaving profound consequences. The old cynicism of a very old people had increased. The lack of morality in public life which had characterized fascism was not entirely remedied, and new generations wholly innocent of democratic processes still found it easier to accept slogans and goals which were only thinly separated from Fascist ideology. The recovery of the mind was going to be a slower process than the recovery of the body. (See also FASCISM.)

THE TRANSITIONAL PERIOD: 1943-1946

With the Allied invasion of Italy, beginning in July 1943, Allied Military Government (AMG) was imposed on the areas freed from German occupation. The existence of AMG did not mean that the Italian state had ceased to exist. A government recognized by the Allied powers was at all times in existence after the downfall of the Fascist regime on July 25, 1943. There was thus no break in the continuity of the Italian state such as occurred in the case of Germany. In practice, the functions of the Italian government

were suspended for a time and then gradually restored as the military front advanced toward the north. By the end of 1945 the Italian government had reacquired substantial jurisdiction over the entire national territory with the exception of the colonies and certain border areas. To a far greater degree than in any other former enemy territory, the functions of AMG were limited to zones of immediate military significance and to a generic and limited task of control of the activities of the committees of national liberation and of the Italian government itself. This limited control points up the fact that in Italy far more than Germany the hold of the Fascist dictatorship was a superficial one, and one quickly eliminated by the unfolding of historical events.

The Forty-five Days.—From July 25 to Sept. 8, 1943, Italy underwent a strange experience. Seeking peace, yet still appearing to fight on the side of Germany, the country got rid of its Fascist government and made a hopeful beginning toward the reassertion of democratic liberties. In this period, Germany refrained from open intervention and occupation of the territory of its ally. Political parties emerged from hiding, and a free press, subject only to normal military censorship, began to appear. In these weeks government was headed by Marshal Pietro Badoglio, whose authority extended throughout the peninsula. The machinery of the state seemed intact, and many Italians hoped that the change from war to peace could be achieved without destructive consequences.

Occupation and Liberation.—The scene changed overnight after the announcement, on September 8, of the armistice concluded with the Allies. Acting swiftly, Germany occupied all of northern and central Italy. (After the fall of Naples, on October 1, the battleline was stabilized north of that city.) The Allied inability to make landings to the north meant the beginning of a long military struggle which ended only in April 1945. As an effective administrative machinery the Italian government disappeared in northern Italy, where a rump Fascist republic was organized under German control in September 1943. Until the occupation of Rome (June 4, 1944), the Badoglio government continued in office. This was the period when the government of Italy was effectively in the hands of AMG. After the liberation of Rome, the first political government was formed under Ivanoe Bonomi, on June 9. Finally, with the liberation of the north, a new government, deemed representative of the new Italian political forces, was formed under the underground leader Ferruccio Parri, on June 17, 1945. The old Italy was fading away, and new political figures were asserting themselves. The Parri government lasted until Nov. 24, 1945. Shortly thereafter, on December 10, the first Alcide De Gasperi government was formed on the assumption that political responsibility should belong primarily to the largest organized political party, the Christian Democrats.

The Republic.—Throughout this period the monarchy survived, if not unchallenged, at least undisturbed. A violent debate raged among the advocates of immediate elimination of the monarchy, of abdication of the king, and of the status quo. It was finally decided to submit the issue to a popular referendum to be held on June 2, 1946, together with elections for a con-

stituent assembly. Shortly before the date fixed for the referendum, on May 9, Victor Emmanuel III abdicated in favor of his son, who ascended the throne as Humbert II. This move was interpreted as an attempt to improve the chances of the monarchy by eliminating from the debate the person judged by most to bear a heavy responsibility for fascism.

The results of the referendum went against the monarchy by a fairly small margin (12,717,932 to 10,719,284), with the north voting overwhelmingly in favor of the republic and the south overwhelmingly in favor of the monarchy. The new king accepted the results of the referendum after some hesitation and left with his family for Portugal on June 13. With the proclamation of the Italian Republic on June 10, the 9-century rule of the house of Savoy came to an end.

THE POSTWAR POLITICAL LANDSCAPE

The accompanying table compares the results of the last Italian elections before fascism and of the two general elections of 1946 and 1948. The figures show that the Right and Liberal Center suffered major defeats in the 1946 and 1948 elections, with many of their followers voting in 1948 for the Christian Democratic Party because of its strong anti-Communist position. The Christian Democrats gained ground steadily since 1921, with a remarkable upswing in the 1948 elections. Their parliamentary majority after 1948 had no precedent in the history of Italy since 1876. The percentage strength of the Marxist parties remained substantially the same in 1946 and 1948. Since 1921, however, the Communists gained much more than the Socialists. In the elections of 1948 the Christian Democrats improved their position throughout the country, while the Communists, defeated in their strongholds in the industrial north, made up for the loss by gaining among the peasants of the south.

From the point of view of ideology, the Christian Democratic Party, which bore the main burden of governmental responsibilities following the 1948 elections, occupied a difficult middle position between the old individualistic approach

to the methods to be followed and to the choice to be made between different solutions stood out in contrast to the simplified centralizing solutions of the Marxist parties. With regard to the equally important question of limits to state intervention, the Christian Democrats proposed that private activities should have full room for development and that state intervention should not extend to more than a part of the economic activity of the country.

To the Communists, questions of limits, procedures, and alternatives had a more limited appeal, since they did not occupy a middle position on the political stage, but wholeheartedly favored a given type of political and economic solution based theoretically on Marxism, but practically on the interpretation which Soviet Russia has given of Marxism. As such, they were the bearers of a specific set of economic and political solutions which they claimed to be the true solutions from which no deviation was possible. They had before them the concrete example of the Soviet Union and did not intend to deviate in any substantial respect from the general structure established there. The compromises which the Italian Communists appeared in 1948 to be willing to accept, such as the right of the individual peasant to own his own land, did not have a persuasive quality and were not believed to have any chance of survival in an economy as fully collectivized as that envisaged by the Communists. Their view of government appeared to be one in which there would be no room for the peaceful rotation in office of different political parties. It is true that in 1945 a leading Italian Communist said that he saw the possibility of normal competition between two fundamental political currents, the bourgeois or conservative one on the one hand, and the popular or progressive one on the other. But more and more thereafter the Communist tendency was to identify as democratic forces only those whose political activities could be tolerated from the Communist point of view or, at any rate, not to consider any government democratic in which the Communists did not participate.

ELECTIONS TO THE ITALIAN CHAMBER OF DEPUTIES
VOTES AND SEATS: 1921, 1946, AND 1948
(Votes in thousands)

Parties	1921			1946 ¹			1948 ²		
	Votes	Per cent of total	Seats	Votes	Per cent of total	Seats	Votes	Per cent of total	Seats
Right	1,290	19.6	107	2,626	11.4	66	1,934	7.4	32
Liberal Center	1,712	25.9	157	2,287	10.0	55	1,215	4.6	19
Christian Democrats	1,347	20.4	108	8,083	35.2	207	12,752	48.7	307
Socialists	1,631	24.7	123	4,745	20.7	115	4,739	18.4	81
Communists	305	4.7	15	4,343	18.9	104	4,886	18.5	132
Others	323	4.7	25	869	3.8	9	638	2.4	3
Total	6,608	100.0	535	22,953	100.0	556	26,164	100.0	574

¹ Constituent Assembly.

² Figures rearranged to make them comparable with previous returns.

to economic and political problems and the new collectivistic concepts. If, on the one hand, it was anxious to maintain the value and the function of the individual citizen in a political sense and to build a constitutional system in which individual freedoms would be strongly guaranteed, on the other, it stressed the need for collective intervention and planning in the economic sphere. Here, again, however, the importance attached

After World War II, the Socialists in the main tended to go along with the general attitudes and policies of the Communists, and it soon became clear that the party leadership aimed at an eventual fusion of the two parties. To the old-line Socialists, brought up in the humanitarian and free traditions of the British Labour Party, the possibility of adhering entirely to Communist theories and practices did not look at-

tractive. When all efforts failed to maintain the Socialists as an autonomous party, the anti-Communist Socialists split from the main body of the party in January 1947, and two Socialist parties resulted. Thereafter, the larger of the two pursued a policy of close alliance with the Communists over what appeared by 1949 increasing internal opposition. The other tried to maintain itself as an independent workers' movement inspired by Marxism but modeling its political activities on the pattern established by the Socialist parties of western Europe. In the elections of 1948 this group won over to its side the allegiance of some middle-class groups which had hitherto been frightened by the Communist leanings of socialism.

THE CONSTITUTION OF 1948

The Italian Constitution is the result of a year-and-a-half's work by the Constituent Assembly elected in June 1946. The final text, approved by the assembly in December 1947, and put into effect on Jan. 1, 1948, without need for popular referendum, reflects on the whole, and to a greater extent than had the original draft, the numerical superiority of the Christian Democrats over the Marxist parties. It retains, in less ambiguous terms and with greater attention to the demands of common sense, the major solutions which had asserted themselves since the opening of the debate:

(1) A bill of rights which, in its political aspects, is inspired essentially by the individualistic tradition of human rights.

(2) A bill of economic rights and duties incorporating the contemporary version of the duties of the community and of the state toward the individual, and of the duties of the individual toward the state, such as his duty to work. There is no specific mandate to nationalize basic industries.

(3) A central administrative system which has yielded some of its powers in favor of regionalism. Nevertheless, sufficient power is vested in the central government to make the reality or ultimate success of the regional experiment a matter of doubt.

(4) A parliamentary system of government in which a balance of power between the executive and legislative branches is envisaged. Two equally powerful legislative bodies, a Chamber of Deputies and a Senate, are provided for.

(5) A Constitutional Court. For the first time in Italian history, an attempt has been made to imitate the American tradition of a court with power to declare laws unconstitutional.

The Bill of Rights.—The constitution vests sovereignty in the people and declares Italy to be a democratic republic based on labor. The initial attempt to declare that political rights are dependent upon the fulfillment of some activity or function contributing to the material or spiritual development of society was abandoned, as were several other Communist-inspired imitations of phraseology borrowed from the Eastern European "people's democracies." With certain limitations, all fundamental personal and political freedoms are recognized. Two of these limitations deserve mention. First, all secret associations are forbidden, as are groups which pursue political aims through military means. The revival of Fascist societies is prohibited. Second, in guaranteeing freedom of the press and of other means of communication of thought, the constitution de-

clares that violation of press laws may justify government seizure in cases of extreme urgency and in cases where judicial intervention cannot be obtained in time to prevent publication of the offending material. Judicial support must, however, be procured within 48 hours in order to validate such action.

Trade unions must be organized democratically and must obtain recognition by the state. Thereafter, unions may negotiate collective contracts binding upon all workers affected by the contract, whether they are union members or not. The right to strike may be exercised only within the limits of the laws regulating it.

Both private and public property are recognized. The former is guaranteed by law, although limits may be set to its accumulation and use in order to make it accessible to all and to establish equitable social relationships. For the sake of the general welfare, the state may transfer to itself or to workers' or consumers' cooperatives enterprises in the fields of public service and power, and monopolies. By recognizing the general principle that certain fields of economic activity may come under state supervision, while private property and the right of private economic initiative survive, the constitution makes possible an experimental approach to the problems of the future.

Church and State.—The problem of the relationship of the Italian state to the Roman Catholic Church had finally been settled by the Lateran Treaty and the Concordat of 1929. The Lateran Treaty resolved the question of the pope's temporal possessions in Italy. On the one hand, papal sovereignty over the state of Vatican City was recognized; on the other, the pope gave belated official acknowledgment of the unity of the Italian people by recognizing the Kingdom of Italy as then constituted. In the concordat, the wholly different matter of the relationship between church and state in Italy was settled. Roman Catholicism was recognized as the state religion, and the right of the Italian government to approve the appointment of bishops was admitted, while the requirements of religious teachings and the legal validity of religious marriage were recognized.

After the end of fascism, no responsible voice was raised to maintain that the Lateran Treaty should be abrogated. The territorial and political settlement contained in that treaty still appeared the best solution of a difficult problem. But the concordat was viewed in a different light. Disregarding the privileges which had been granted to the Italian government, which permitted it to control to a large extent the life of the church in Italy, the critics of the concordat objected to the provisions which gave the Roman Catholic religion a position which formally could not be equaled by other religious confessions. The proposals advanced varied from outright repeal to substantial modifications, particularly in the direction of ending the recognition of Roman Catholicism as the state religion. Against these proposals the Christian Democratic Party waged a successful fight. Article 7 of the constitution, voted with full Communist support, reads: "The state and Catholic Church are, within their respective spheres, independent and sovereign. Their relationships are regulated by the Lateran treaties." This makes the Concordat of 1929 a part of the constitution. The unbalance created by this inclusion, deprecated by some as unwise, is re-

dressed, however, by a further provision passed by all other parties over Christian Democratic opposition, which makes future negotiated changes possible without the need for amending the constitution, as well as by Article 8, which declares all religious faiths equally free before the law and recognizes their right to organize themselves freely.

Regionalism.—The attempt made, principally by the Christian Democrats, to decentralize the traditionally highly centralized administration of Italy was a reaction against the Fascist regime's intensification of controls from the center, as well as an endeavor to embody in the constitution the Christian Democratic belief that the region is a natural body which cannot be suppressed. The constitution represents a compromise between the Christian Democratic position and the Communists' insistence that a strong central government would be necessary for postwar economic reconstruction.

The two main traditional units of local government had been the commune (municipality) and the province, the latter being the chief subdivision through which the central government exercised its control over local affairs. Under the Constitution of 1948, an entirely new entity—the region—was created. The boundaries of the regions generally follow the historical boundaries which separated the various states before the unification of Italy. Nineteen autonomous regions are recognized, while special privileged positions are given to the islands of Sicily and Sardinia and to the three frontier regions of Friuli-Venezia Giulia (bordering on Yugoslavia), Trentino-Alto Adige (bordering on Austria), and Valle d'Aosta (bordering on France and Switzerland).

The constitution embodies the following principles:

(1) Each region is governed by a popularly elected regional council, which in turn chooses the regional executive, the president.

(2) Subject to the general principles established by national laws, and provided the national interest and the interests of other regions are safeguarded, the region may issue legislative norms in the fields of local administration and police, local markets and public works, public welfare and health, professional schools, local transportation, agriculture, forestry, and town planning.

(3) In order to carry out its functions, each region is to have financial autonomy within the limits established by national laws. Regions may acquire funds either through their own taxation or through receipt of parts of the revenue of the central government.

(4) The central government maintains powers of control over the regions in several significant ways:

(a) Regional councils can be dissolved for acts contrary to national unity, serious violation of national laws, failure to remove the regional president after the central government has asked for his removal for similar acts, reasons of national safety, or inability of a council to function. This power of dissolution is exercised by the president of the republic after he has heard a joint parliamentary committee on regional questions. The control thus given to the central government is sufficient to indicate that regions are far from autonomous.

(b) The government maintains continuous control over the legislative enactments of the

regions. Laws approved by a regional council must be transmitted to a representative of the national government resident in the regional capital. The government can return them to the council because they exceed regional jurisdiction or conflict with the interests of the nation or of other regions, or can challenge their constitutionality.

(c) Each region is to have a constitution or statute of its own. First approved by the regional council, the statute must also be embodied in a law of the republic. Presumably, it would not be approved if it contained anything considered to conflict with the national constitution.

In summary, it may be said that useful tasks of a local nature are given to the regions, and opportunity is afforded for training in citizenship, administration, and independent thinking. This is a positive gain over the old system. Nevertheless, this attempt to combine strong central administration with quasi federalism leaves a sufficient preponderance of power in the national government to indicate that regions are not to play as significant a role as the Christian Democrats had hoped.

Legislative Power.—Defeating all Communist proposals in favor of a single legislative assembly, the Constituent Assembly organized the legislative system as follows:

(1) Legislative powers are divided equally between a Chamber of Deputies and a Senate. Each has jurisdiction and powers equal to the other. The two chambers are brought together as a National Assembly in cases prescribed by the constitution.

(2) The Chamber of Deputies is elected for a term of five years by universal suffrage. The system of election, not provided for in the constitution, is that of proportional representation with preferential voting. The number of deputies is 574.

(3) The Senate is elected on a regional basis with each region except Valle d'Aosta sending at least six senators. There is one senator for every 200,000 inhabitants. Senators hold office for six years and are elected under a hybrid system combining features of both majority and proportional representation. Total normal elective membership of the Senate is 237. In addition, but for the period 1948–1954 only, there are a number of senators of right. (In 1948, there were in all 344 senators.)

(4) Since the two chambers have equal legislative powers, unresolved conflicts would presumably lead to dissolution by the president of one or both of the chambers. The constitution itself is silent on this point.

(5) The limited use of popular referendum and initiative is admitted.

The President of the Republic and the Cabinet.—Both the initial draft and the final text show a strong effort to create a relationship between executive and legislature similar to the British one. The final text, overcoming Communist-Socialist opposition, provides for greater executive powers than even the draft had allowed.

The president of the republic is elected for seven years by the two chambers meeting in joint session, and by three representatives from each regional council except that of Valle d'Aosta, which sends one representative. His foremost power is that of dissolution of the chambers at any time except during his last six months in office. He can send back to the chambers, within

the time limit allowed for promulgation, and with a message stating his reason for such action, any bill of which he disapproves. Presidential promulgation must follow if the bill is again approved by the chambers. He can also send general messages to the chambers, and he must authorize the presentation of government bills. In addition to the powers already mentioned, the president, as chief of state and symbol of national unity, receives and accredits diplomatic representatives, ratifies treaties, commands the armed forces, and declares war upon decision of Parliament.

The prime minister and, upon his advice, the members of the Cabinet are appointed by the president. The Cabinet as a whole must seek the confidence of Parliament within 10 days of its appointment and must continue to enjoy that confidence if it is to remain in office. A vote of nonconfidence by one house is sufficient to overthrow a Cabinet, but three days must elapse before a vote on a motion of nonconfidence may be taken.

The prime minister is responsible for the direction of the general policies of the government and for the maintenance of unified political and administrative action among the ministries. Executive decree laws are legitimized, though only in extraordinary cases of necessity and urgency, and under rigid conditions.

The Constitutional Court.—The strongest pressure in favor of a Constitutional Court came from the Christian Democrats.

The court is composed of 15 justices nominated for terms of 12 years, one third by the president, one third by Parliament, and one third by the highest ordinary and administrative courts. It has jurisdiction over the constitutionality of both national and regional laws, conflicts between regions and the national government, and the impeachment of the president and Cabinet members. The question of constitutionality may be raised by the bench or by either party to a judicial action. Decisions of the court are final, and laws declared unconstitutional cease to have effect one day after publication of the court's decision. There is no time limit on the testing of a law's constitutionality.

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NOTE: The foregoing 10 articles on Italy were prepared under the joint direction of the editor of the *Encyclopedia Americana* and Dr. Mario Einaudi, professor of government at Cornell University.

ITALY, Free Church in, the Evangelical Italian Church, a reformed religious sect founded in 1870 by Alessandro Gavazzi (q.v.). In 1874, a confession of faith was formulated, an ecclesiastical constitution framed under a general assembly, and the title "Free Church in Italy" assumed. The confession resembles that of other Protestant churches, and the constitution is based on a government by elders, like that of the Presbyterians, although the several congregations are practically uncentralized. In 1891, by royal decree, the title "Chiesa Evan-

gelica Italiana" was given to this body. Elementary and Sunday schools are maintained. The schools of the church in Florence are partially supported by the state, and a gift bought and presented by British friends is the old church of San Jacopo, Florence.

ITASCA, i-täs'kà, **Lake**, farthest source of the Mississippi, in Clearwater County, northwestern Minnesota. It is located at about 47°13'10"N., and 95°12'W., at an altitude of 1,457 feet above sea level. It was first definitely proved to be the source of the Mississippi by Henry Rowe Schoolcraft (q.v.) in 1832, as a result of a journey of exploration undertaken under the auspices of the United States government. At the same time it received its name by a fanciful combination of the last four letters of the Latin word *veritas* (truth) and the first syllable of *caput* (head). The ground has a substratum of sand and gravel, mingled with large boulders, and the surface is swampy. The basin has been made into a state park of 30.78 square miles. In the center, fed by springs so permanent and with a flood plain so small that it has actually risen in dry seasons, is the lake, which has an area of only 1¼ square miles. It consists of a center running east and west for about a mile, with two arms in the south, each about 1½ miles long, and another in the north about 1 mile long. The shoreline extends more than 13 miles; the average depth is 20 to 35 feet. The Mississippi flows from the north arm. See also MISSISSIPPI RIVER. Consult Clarke, H., *The Source of the Mississippi* (New York 1886); Winchell, N. H., "The Source of the Mississippi," *Collections, Minnesota Historical Society*, vol. 8, p. 226 (St. Paul 1898); Brower, J. V., *Itasca State Park* (St. Paul 1904).

ITATA CASE, 1891, the cause of differences between Chile and the United States, resulting from the revolt against President José Manuel Balmaceda (q.v.) by the Congressional Party. The latter through an agent had bought a quantity of arms and ammunition in New York, which were shipped to San Francisco and then sent by schooner down the coast, where the cargo was transferred to the insurgents' vessel, the *Itata*. The attorney general issued a writ of detention on the ground that the *Itata* was violating United States neutrality laws. The ship set sail, however, and the U.S.S. *Charleston* was sent in pursuit, overhauled and captured her, and placed her on trial in the United States district court in San Diego. The court discharged the vessel as not having been guilty of violation, but its detention angered the Congressionalists, who had meanwhile been successful in overthrowing Balmaceda. Consult Godkin, E. L., "Itata Case," *The Nation*, 52: 416 (1891).

ITCH, a contagious eruption of the skin caused by its invasion by the itch mite (q.v.). See also SCABIES.

ITCH MITE (*Sarcoptes scabiei*), a parasitic mite which enters the skin and multiplies, causing itch or scabies. The female itch mite, which is longer than the male, is about one fifth of an inch in length and is visible to the naked eye. In order to penetrate the horny layer of the epidermis, the mite assumes a nearly perpendicular position; and to avoid as much

trouble as possible, it usually selects such spots as give least resistance, such as the space between the fingers, the inside of the wrists, or the groin. Once fairly buried it does not again come out but burrows, and forms tortuous galleries within the skin. These galleries resemble the mark which is formed when a pen is drawn lightly over the skin without causing a scratch. At certain intervals the galleries are pierced by small openings for the admission of air. The vesicles characteristic of the itch disease are attributed to a poison ejected by the mite.

For treatment soften the affected area by massaging it with green soap and warm water, then apply a sulphur ointment. All clothing that has come in contact with the infection should be boiled.

ITHACA, city, New York, and seat of Tompkins County, at an altitude of 389 feet, situated at the southern end of Cayuga Lake, 29 miles northeast of Elmira, and served by the Lehigh Valley and the Delaware, Lackawanna and Western railroads and state highways. Its industrial products include power drive chains, adding machines, shotguns, salt, cement, ladies' underwear, electric clocks, fertilizers, clay products, leather goods, paper, technical apparatus, and shirts. Through Cayuga Lake, the city has shipping access to the New York State Barge Canal System, and it also has a municipal airport, one mile outside the city, with a scheduled airline service.

One of the major educational centers in the state of New York, Ithaca is the seat of Cornell University (q.v.), the state colleges of Veterinary Medicine (founded 1894), Agriculture (founded 1904) and Home Economics (founded 1925), all located on the Cornell University campus, and Ithaca College, founded in 1892, with over 1,300 students (1951). The city's library has some 48,000 volumes, the Cornell University library more than 1,500,000 volumes. The historical society maintains a museum, and there are several special museums at Cornell.

The city has three general hospitals and one state hospital. There are three state parks nearby and Stewart Park, at the head of the lake, is the city's principal place of outdoor recreation. It has as notable and distinctive features the Renwick Bird Sanctuary and the Fuertes Wildfowl Sanctuary. These refuges are maintained by the city in cooperation with the ornithology department of the university. There is a memorial gateway with a tablet commemorating Louis Agassiz Fuertes, who was born at Ithaca and painted many of his famous bird pictures there.

First settled in 1788, Ithaca was named by Simeon De Witt, surveyor general of New York State, in 1806, following a military survey of central New York. It was during that time, the first decade of the 19th century, that many towns received names of ancient Greek and Roman origin. It was incorporated as a city in 1888 and the government is by a mayor and council of 14. Pop. 28,799.

ITHACA, ìth'á-ká (Gr. Ἰθάκη, ê-thä'kyê), one of the Ionian Islands, Greece, and the smallest except Paxos, 17 miles northwest of the mainland of Greece and two miles northeast of Cephalonia, with which it forms Cephalonia Department. The surface is divided into two mountainous masses, with a narrow isthmus between, but there

are many pleasant valleys. The chief products are wine, currants, and olive oil. The island has an area of 36 square miles and was celebrated among the ancients as the home of Odysseus (Ulysses). Vathy (or Ithaca) is the capital. Pop. (1951) 7,083.

ITINERANCY, î-tin'ér-àn-sî, a passing from place to place. In ecclesiastical usage, the Methodist system of limited pastorates instituted by John Wesley. In the American Methodist Episcopal Church no time limit has been placed on pastorates since 1900, although the bishop appoints preachers from year to year. See also **METHODISM**.

ITINERARY or **ITINERARIUM**, the schedule of a route or table of the stages between two places of importance with the distances from one to another. Much of our knowledge of ancient geography is due to the itineraries issued by ancient peoples. Of these the best known are *Itinerarium Antonini*, a sketch of the stations and distances along various Roman roads; *Itinerarium maritimum*, giving the distances from Corinth to Sicily and Carthage, made during the reign of Antoninus Pius; and *Itinerarium Hierosolymitanum*, made by a Christian pilgrim in 333 A.D. The first mentioned itinerary contains the *Itinerarium Proviniarum Anto(ni)ni Augusti*, further accounts of distances and stations in the Roman provinces.

ITIUS PORTUS, the port on the French coast, nearly opposite Dover, from which Julius Caesar sailed on his second expedition to Britain in 54 B.C. Its position has been a matter of much controversy, but the majority of geographers identify it with Wissant, a village nine miles west-southwest of Calais.

ITO, ê-tô, **MARQUIS Hirobumi**, Japanese statesman; b. Choshu, Sept. 2, 1841; d. Harbin, Manchuria, Oct. 26, 1909. His father was a samurai retainer of the daimio of Choshu, with whom the youth became a trusted agent in his opposition to the shogunate. While at Yedo in the interests of his chief, Ito became acquainted with western methods of warfare, consequent on the visit of Commodore Matthew C. Perry in 1854, and determining to study these in their native countries, with four comrades, including Kaoru Inouye, left Japan secretly, and eventually arrived in London. Diplomatic complications arising, owing to his daimio ignoring the right conferred by the shogun on European powers to navigate the Inland Sea, Ito hastened home before two years had elapsed, but was unsuccessful in his efforts to persuade the daimio of Choshu from opposing the European fleets assembled at Shimoda. The daimio defeated, Japan awakened to the power of the West, and Ito became the impelling factor in its reorganization on models more in accord with the leading powers of the world. He took an active part in the overthrow of the shogunate and the restoration of the imperial power in the person of the emperor or mikado; in 1868 was appointed governor of Hiogo, and in 1869 vice minister of finance. He then became prominent as an advocate of uniform coinage. In this connection he visited the United States and after studying the financial system of that country returned to Japan with the recommendation that the decimal system of money be

adopted, which was done, and a mint established at Osaka. In 1871-1873 he made a tour of the world, as a member of Prince Tomomi Iwakura's embassy, for the purpose of revising or modifying the treaties then in force. In 1872 he became minister of public works in which office he established a college of engineering and secured the building of the railway from Yokohama to Tokyo. In 1876 he again visited Europe to study the constitutions of the various countries for the purpose of remodelling that of Japan. On his return he inaugurated a radical plan for changing social customs. Having become minister president of state he started these reforms in the government offices, eliminating men of the old schools and substituting men of modern training and thought. He also reconstructed the laws and codes according to the ideas of western countries and carried out many reforms in economy. In 1882, the emperor, desirous of adopting the constitutional form of government, commissioned Ito to proceed to Europe and America in order to investigate the governmental systems of the two continents. While in Europe he attended the coronation ceremony of Czar Alexander III, as a representative of Japan, and returning in the following year, he began the work of drafting the constitution of the Empire. One year later Ito was appointed minister of the imperial household and created count.

As premier for four various periods between 1886 and 1901, he successfully saw the constitution that he and Kimmochi Saionji had so laboriously worked on proclaimed in 1889, was appointed president of the House of Peers when the Japanese Imperial Diet first convened, and concluded with China the Shimonoseki Treaty after the Chinese-Japanese War of 1894-1895 (for which he was created marquis in 1895). He resigned his fourth premiership in June 1901 and was later appointed president of the privy council. He failed to reach an understanding with Russia and at once opened negotiations which resulted in the Anglo-Japanese alliance of 1902. During the war with Russia (1904-1905) Marquis Ito, as one of the "elder statesmen" was the most trusted counsellor of the emperor. After the conclusion of peace which he did much to bring about, he was twice dispatched to Korea, these visits resulting in the Japan-Korea Treaty, declaring the Japanese protectorate over the peninsula. The marquis was ultimately appointed resident general of Korea, which high office he held until 1909 when he retired to become president of the privy council. He was assassinated by a Korean while visiting Manchuria.

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ITRI, town, Italy, in Rome Province, Latium, six miles north-northwest of Gaeta. It contains many ancient remains and has many houses erected from stone taken from the Via Appia, which runs past the town. Itri, with its cork industry, was heavily damaged during World War II. Pop. (1936) 6,219.

ITURBI, ê-tōor'bê, José, Spanish-American conductor and pianist: b. Valencia, Spain, Nov. 28, 1895. One of the finest of concert pianists in contemporary America, Iturbi has given more concerts in the United States than any other pianist, with the exception of Ignace Jan Pade-

rewski, and has broken box office records wherever he appeared.

He studied piano at the Valencia Conservatory (1908) and the Paris Conservatory, graduating with highest honors in 1912. After playing a short while in a fashionable café in Zurich, he became head of the pianoforte department of the Geneva Conservatory (1919-1923), leaving to devote himself to concert recitals. He was an immediate success, touring all of Europe, South America, and, from 1928, the United States with constant acclaim.

In one year alone (1930) he played 77 concerts in America, and during his tours averaged 100 concerts a year. In 1933 he turned his attention to conducting, directing 15 concerts at Mexico City and later that year appearing as a conductor at the Lewisohn Stadium, New York City. He appeared in 1934 as guest conductor of the Philadelphia Orchestra and since then he has continued to conduct major orchestras throughout the United States, being appointed permanent director of the Rochester Philharmonic Orchestra in 1936.

In 1938 he toured South America as conductor and pianist, and in 1941 took out citizenship papers in the United States. He has appeared in several motion pictures, among them *As Thousands Cheer* (1944), *anchors Aweigh* (1945), and *Three Daring Daughters* (1948).

ITURBIDE, ê-tōor-bê'thà, Agustín de, emperor of Mexico: b. Valladolid (now Morelia), Mexico, Sept. 27, 1783; d. Padilla, State of Tamaulipas, Mexico, July 19, 1824. In 1810 he was lieutenant in the provincial regiment of his native city, but on the breaking out of the troubles in Mexico joined the royalist party, and in this cause displayed such valor and ability that in 1816 he rose to the command of what was called the Northern Army, which occupied the provinces of Guanajuato and Michoacán. In 1820 the imprudent acts of the Spanish Cortes produced so much exasperation among the clergy and the partisans of absolutism in Mexico that these persons united to effect the independence of their country, selecting Iturbide as their agent and appointing him commander of the army in the south. He issued with Vicente Guerrero the Plan of Iguala for the unification of Mexico in February 1821, and other revolutionary forces quickly joined him. He quickly bore down all opposition, forced the signing of the Treaty of Córdoba in August 1821 acknowledging Mexico's independence, and was proclaimed emperor of Mexico in May 1822 under the name of Agustín I.

His troubled reign, during which he showed great arrogance, disregard of all constitutional restraints, and cruelty toward his opponents, came to an end in less than a year, by his abdication in March 1823, after Santa Anna's pronouncement against him. He went with his family to Leghorn, Italy, where he resided for a year until he was induced to make an attempt to recover his lost crown. He first went to London where he published his famous *Statement of Some of the Principal Events in the Public Life of Agustín de Iturbide* (translated into English in 1824) and sailed for Mexico, May 11, 1824. He landed with but a single attendant at Soto la Marina on July 15, 1824, but immediately was arrested and four days later was shot by order of the state of Tamaulipas without even being given a chance to appeal to Congress. His remains

were, in 1838, brought to Mexico City and repose in its cathedral. At the same time he was officially invested with the title "Liberator." See also MEXICO—History.

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ITUREA or **ITURAEA**, it-û-rê-â, Biblical country, Palestine, the historical name of the district now in the province of Damascus, Syria, south of Mount Hermon and northeast of the Sea of Galilee. The Ituraeans were seminomadic Arabs, supposed to have been descendants of Jetur, a son of Ishmael, who had migrated northwards from Medina. In the 2d century B.C. they were subjugated by Aristobolus I (Judah), "the friend of the Greeks" and king of Judaea, who added their land to his kingdom and compelled them to accept Judaism. In 20 B.C. the district came under the rule of Herod the Great and at his death (4 B.C.) fell to his son Philip the Tetrarch, who is mentioned by Luke 3:1 as tetrarch of the Iturean and Trachonitic region. In 44 A.D. the district became part of the Roman province of Syria, and many of the inhabitants became soldiers in the Roman legions. They were celebrated as archers, brave and fearless, often mentioned by Julius Caesar, Strabo, and Flavius Josephus. Marc Antony is accused of attempting to intimidate the Roman Senate with his Ituraean guards by Cicero in his *Philippics*.

ITZA, êt'sâ, a Mayan people of northern Guatemala. They came thither from Yucatán in the 15th century after the fall of the Maya Empire and settled on the shores of Lake Petén. Hernando Cortes saw them in 1525 but the Spaniards did not subdue them until 1697 when their city was taken and pillaged. The records of this people date back to the 4th century and references to them are frequent in all Maya chronicles. Many of their records were destroyed by the Spaniards at the time of the conquest.

ITZCOATL, ish-kô-â-t'l, or **IZCOHUATL**, first Aztec emperor: b. 1360?; d. ?1440. His reign began in 1427. With his tribe of Tenochas he formed a confederacy with the rulers of Texcoco and Tlacopan against Maxtla of Tepanec, whom they captured after a short campaign and sacrificed to their gods. Itzcoatl instituted many reforms and greatly improved the state of his realm, making Tenochtitlán (Mexico City) a great power and cultural center.

Consult Bancroft, H. H., *Native Races*, vol. 5 (San Francisco 1882).

ITZEHOE, it'sê-hô, town, Germany, in Schleswig-Holstein, on the Stor River, 33 miles northwest of Hamburg. It has cement factories, carpet mills, sugar mills, and shipyards, and manufactures soap, chemicals, cigars, nets, wall-paper, machinery, and pumps. It carries on a considerable trade in cattle, grain, lumber, and wine. Among its ancient buildings are the 12th century church of St. Laurence and a convent, now Protestant, founded in 1256. It grew around a castle erected here in 809 and is consequently the oldest town in Holstein, receiving municipal rights in 1238. Pop. (1956) 34,257.

IUKA, i-û'ká, town, Mississippi, seat of Tish-

omingo County, 20 miles east-southeast of Corinth, served by the Southern Railroad, in the extreme northeast part of the state. It has manufactures of brick, tile, and crossties, and there are limestone, sandstone, and clay deposits and a mineral spring nearby.

The town was the scene of a severe engagement during the Civil War. Early in September, 1862, it was occupied by a small Union regiment as an outpost. On the morning of September 13, Gen. Sterling Price, moving north from Tupelo with a force of 14,000 men, drove the Union regiment from the village and occupied it. Gen. Ulysses S. Grant had been closely watching the movements of Price and when he heard that he had occupied Iuka he determined to attack. Gen. William S. Rosecrans, who was near Corinth with 9,000 men, was ordered to move south to Rienzi and Jacinto, then eastward and, marching on the roads from Jacinto and Fulton, to attack Iuka from the south. Gen. Edward O. C. Ord, with 6,000 men, was to move along the Memphis and Charleston Railroad to Burnsville, thence by roads north of the railroad, and to attack on the north and west of Iuka.

General Rosecrans made first contact with the enemy on September 19, but due to a confusion of orders, General Ord failed to thrust down at the same time, allowing the Confederate forces to escape from the trap after a severe fight. General Price retreated southward and reached Baldwyn on September 23d. Rosecrans and Ord returned to Corinth. Rosecrans reported a loss of 141 killed, 513 wounded, and 36 missing; Price reported a loss of 86 killed and 408 wounded, although Union estimates placed it much higher. The town was incorporated in 1857. Pop. 2,010.

IVAN I, i-vàn' (called **IVAN KALITA**, *Moneybags*), prince of Vladimir and grand duke of Moscow: d. 1341. As the prince of Vladimir he was made collector of taxes by the Tatar khan, and by following the policy of rigorously enforcing the payment of tribute to the Tatars, he was able in a short while to dominate Moscow and Tver and also assure his realms of privacy from Tatar intervention. He became grand duke of Moscow in 1328 and vastly extended the dominions of his empire, annexing Rostov in 1330 and Smolensk in 1340. He worked ceaselessly for the unification of his realm, overseeing monetary matters even to the smallest amounts (hence his nickname, Moneybags) and causing the metropolitan see to be transferred to Moscow, thus increasing immensely the importance of the Muscovite kingdom.

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IVAN II (called **IVAN KRASNÝ**, *the Red*), grand duke of Moscow: b. 1326; d. 1359. The younger son of Ivan I, he became grand duke of Moscow in 1353. Novgorod and several other principalities refused to recognize his title and waged war with him until 1354. His rule was generally weak and colorless, with most of his principalities vowing allegiance but privately going their separate ways. He was the father of Demetrius Donskoi, who built the Kremlin and fought against the Tatars, and by his will divided his dominions among his children, thus increasing the internal discord. For bibliography see **IVAN I**.

IVAN V, Romanov czar of Russia: b. Aug. 27, 1666; d. Jan. 29, 1696. The son of Czar Alexis I and the half brother of Peter I, with whom he shared the throne, he was a physically and mentally weak ruler, leaving the management of his affairs entirely to his half sister, Sophia, who attempted through various ruses to dethrone Peter and have herself proclaimed empress. Meanwhile Ivan gave himself entirely to religious devotions, and when Sophia was overthrown in 1669 he was deposed. One of his five daughters, Anna Ivanovna, later ascended the throne as empress (r. 1730–1740).

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IVAN VI, Russian czar: b. Aug. 24, 1740; d. Dec. 5, 1764. He was the son of Princess Anna Leopoldovna and Prince Anthony Ulrich of Brunswick-Bevern and the great-grandson of Ivan V. He was named successor to the Russian throne by Anna Ivanovna and on her death in 1740 was proclaimed czar at the age of eight weeks, under the regency of Ernst Johann Biron, duke of Kurland. The latter was overthrown by Ivan VI's mother who assumed the regency, and in December 1741 Elizabeth, the younger daughter of Peter the Great, through a coup d'état, became empress. The infant czar was thrown into prison where he was destined to spend the rest of his days. In the fortress of Schlüsselburg, after 22 years of solitary confinement which had succeeded in deranging his mind, he was murdered by some officers in whose charge he was put to forestall an effort to liberate him.

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IVAN III VASILIEVICH (called **IVAN THE GREAT**), grand duke of Moscow: b. Jan. 22, 1440; d. Oct. 27, 1505. He succeeded his father, Basil II, as grand duke of Moscow in 1462 and continued energetically to strengthen the leadership of Moscow. From 1471 to 1478 he waged two wars on Novgorod, the strongest principality next to Moscow in Russia, and finally conquered and annexed it to the Muscovite kingdom. To further unification, he refused to recognize his brothers' claims to continue lineal inheritance of their principalities and by threat or actual war annexed the principalities of Yaroslavl (1463), Rostov (1474), and Tver (1485).

In 1480 he refused to pay the onerous tribute to the Tatar khan and successfully threw off the yoke of Tatar rule in spite of attempts by the latter to regain sovereignty by threat of arms. To gain access to the sea, he twice invaded Lithuania (1492 and 1501), finally acquiring in 1503 a part of it by treaty.

As a result of his second marriage in 1472 to Sophia (Zoë), daughter of Thomas Palaeologus, brother of the last Byzantine emperor, autocratic forms of government and court ceremonies gradually developed at Moscow. This marriage was also important, in establishing the claim of Moscow as the protector of Orthodox Christianity. As a further symbol of his identity with the Byzantine Empire and Orthodox Christianity, he adopted the Byzantine double-headed eagle into the Muscovite coat of arms. Ivan did much to

introduce western civilization into his domains and was also responsible for the compilation of the first Russian law code. The boyars or nobles fell from their high position as advisors to the duke and became mere fiefs of the sovereign. By his last will, leaving all his dominions to the next reigning grand duke rather than dividing them customarily among his children, he established Muscovy as a permanently unified realm.

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IVAN IV VASILIEVICH (called **IVAN THE TERRIBLE**), Russian ruler: b. Aug. 25, 1530; d. March 17, 1584. The son of Basil III and grandson of Ivan III, he was proclaimed ruler of Muscovy at the age of three, ruling under the regency of his mother until 1538 and under the regency of the boyars from 1538 to 1544, when at the age of 14 he assumed control of the kingdom himself. On Jan. 16, 1547 he had himself crowned czar of Russia, the first ruler to dare do so, and immediately began forming his government. Having formed a lasting hatred of the power-conniving boyars, he completely broke with them and surrounded himself with able men of humble origin whose interests were primarily for the good of Russia and not themselves.

In 1550 he held the first meeting of the national assembly (Zemski Sobor) and in 1551 he even went so far as to submit a hundred questions to a gathering of prelates concerning the betterment of the government. Constantly seeking ways to enlarge his kingdom, he conquered the khanates of Kazan in 1552 and Astrakhan in 1554. His efforts to acquire additional territory in Livonia and Estonia, though carried on with large forces from 1557 to 1582 almost without intermission, failed as a result of the stout resistance of Poland and Sweden. It was during his reign that the conquest of Siberia was completed by Cossack forces under Ermak Timofeev.

Ivan IV was a peculiar mixture of political sagacity and admiration of western civilization and eastern barbarity. He was an indefatigable worker, comparatively well educated, but possessed such a strong strain of cruelty and immorality that it amounted at times almost to madness, especially after a series of events, including the death of his wife and son, turned him against the world and made him suspect all of attempting to harm him. Amongst his many barbarous deeds was the almost complete destruction of Novgorod and the slaughter of thousands of its inhabitants as punishment for an unproven attempt at revolution (1570). Another deed of similar nature was the killing of his beloved son Ivan by a blow, given in a moment of uncontrollable fury. Twice during his rule (1564 and 1580) he publicly expressed a desire to abdicate, but was persuaded to continue on the throne.

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IVANHOE, i'văn-hō, a romantic novel of love and adventure in the days of chivalry, by Sir Walter Scott, published in 1820. The scene is England during the late 12th century when sturdy Saxon yeomen still hoped for restoration of their royal line and expulsion of the hated Norman conquerors—those brilliant feudal lords, endowed with all knightly graces but haughty and tyrannical. Scott provides memorable pictures of these antagonistic elements. The patriarchal home of Cedric the Saxon, in which master and serf live on terms of kindly familiarity, contrasts with life in a typical Norman castle, with courtly manners of hall and bower and the dark mysteries of its gloomy dungeon. Cedric's son Ivanhoe has been disinherited because of his love for the noble Saxon heiress Rowena, whom Cedric hopes to marry to a descendant of Edward the Confessor and thus, by uniting Saxon factions, compass a restoration of the ancient Saxon monarchy. The large and varied cast of characters includes Richard Coeur de Lion, King John, Robin Hood, a Knight Templar Brian de Bois Guilbert, a proud nobleman Maurice de Bracy, the Jew Isaac and his beautiful and virtuous daughter Rebecca.

JAMES H. HANFORD.

IVANOVO, i-vă'nŭ-vŭ, oblast, USSR, in the central European part of the Russian SFSR. It is a wooded steppe area with a moist climate, 9,500 square miles in area. The region has large cotton cloth and chemical industries, and mines peat extensively. There are textile centers at Ivanovo (the capital), Rodniki, Furmanov, Kokhma, and Teikovo, and linen mills at Privolzhsk and Puchezh. Agriculture is important, the main farm products being truck produce, dairy products, tobacco, chicory, wheat, and flax. The oblast was formed in 1929. Pop. (1956 official est.) 1,351,000.

IVANOVO, city, USSR, capital of Ivanovo Oblast in the Russian SFSR. It lies south of the Volga River, about 155 miles northeast of Moscow on the unnavigable Uvod River. It has railways to Moscow, the Ural Mountains, and Archangel. The town of Ivanovo was founded in 1328 and during the 17th century became a commercial center. The city was formed in 1871 by the merger of the two towns of Ivanovo and Voznesensk, and until 1932 it was officially styled Ivanovo-Voznesensk. The city is often called the "Soviet Manchester" because it is one of the largest centers for cotton cloth manufacture in the USSR. There are also machine-building factories and other heavy industries. Most of the city's colleges and research institutes specialize in textile and chemical studies. The large worker population took an active part in the revolution of 1917-1918, and the town was made temporary capital of the revolutionary government in 1918. Pop. (1956 official est.) 319,000.

IVES, Burl (Icle Ivanhoe), ivz, American guitarist and folk singer: b. Hunt Township, Jasper County, Ill., June 14, 1909. He learned to sing Anglo-American folk songs and ballads in childhood, from his parents (Frank and Cordella White Ives) and his grandmother (Kate White), and at the age of four earned his first quarter by singing *Barbara Allen* at an old soldiers' picnic. After graduating from Newton (Ill.) High School, he studied (1927-1929) at Eastern Illinois State Teachers College in Charleston, where he

paid for his meals by singing to the accompaniment of his banjo and guitar. In 1929 he embarked on an extended trip, during which he hitchhiked, rode the rails on freight trains, and earned his living by singing in Canada, Mexico, and 46 of the United States. Later he settled in Terre Haute, Ind., where for two years he sang over the local radio station and played professional football. For several months he was a member of the Reverend J. Frank Norris' company of traveling evangelists.

About 1937, Ives went to New York City, where he lived for a time at International House, Columbia University, working as a bus boy and singing in churches. He started his network radio career in 1940, singing first for the National Broadcasting Company and later over the Columbia Broadcasting System in a program entitled *The Wayfarin' Stranger*, named for the title of the ballad he had made famous, *I'm a Poor Wayfarin' Stranger*. He came much in demand for concert appearances, and his phonograph records achieved tremendous sales. His mellow voice and intimate, highly individual style did much to popularize American folk songs, which he presented in a simple and direct manner, without elaborate arrangements or distortions.

Ives also developed a distinguished stage career as a dramatic actor. He first appeared professionally as an actor at the Rockridge Theatre in Carmel, N.Y., in the summer of 1938. Later that year he appeared on Broadway in *The Boys from Syracuse*, and in 1939 in the road company of *I Married An Angel*. In 1942-1943 he was in the United States Army, and appeared in Irving Berlin's soldier show, *This Is the Army*. He subsequently scored a distinguished dramatic success in Tennessee Williams' *Cat on a Hot Tin Roof*, in which he starred on Broadway in 1955-1956. His autobiography, *Wayfaring Stranger*, was published in 1948, and his *Song Book* in 1953.

JOHN TASKER HOWARD.

IVES, Charles Edward, American composer: b. Danbury, Conn., Oct. 20, 1874; d. New York, N.Y., May 19, 1954. An experimentalist in musical forms, Ives is credited with being the pioneer of atonality, first developing such devices as major and minor seconds, quarter tones, polyrhythms, and polyharmonies, which Igor Stravinsky and Arnold Schönberg were to use with success later.

Ives was first taught harmony, counterpoint, and instrumentation by his father, who had served as a regimental bandmaster during the Civil War. As a boy of 13, he was organist at the Congregational Church in Danbury, Conn. At Yale University, where he graduated in 1898, he studied composition under Horatio Parker and organ under Dudley Buck. From 1893 to 1902 he was organist and choirmaster at churches in New Haven, Conn., Bloomfield, N.J., and New York City. In 1898 he became a clerk with an insurance company, and from 1916 to 1930 he was the senior member of Ives & Myrick, one of the largest insurance brokerage firms of its kind in the United States.

Ives' works include 4 symphonies, 4 violin sonatas, 2 piano sonatas, 3 orchestral suites, 11 volumes of chamber music, choral music with or without orchestra, organ music, and about 200 songs. Most of his work was written before 1916, but its extreme deviation from the accepted patterns of music and the author's personal shyness kept the compositions in obscurity for several decades.

Ives continually experimented with unusual chord structures, harmonic rhythms, and exotic scales; the result was music characterized by complex chromaticism and polytonalism. He used American themes almost exclusively in his choral works and songs. His second sonata, *Concord, Massachusetts, 1840-1860*, written between 1909 and 1915, is divided into four movements entitled *Emerson*, *Hawthorne*, *The Alcotts*, and *Thoreau*. Published in 1919 and first fully performed 20

years later, it is considered to be his best piece. In 1947 his *Symphony No. 3*, played the preceding year for the first time with full orchestra, was awarded the Pulitzer Prize. Further recognition followed in 1948 when he received the Henry Hadley Medal from the National Association for American Conductors and Composers.

IVES, Frederic Eugene, American inventor: b. near Litchfield, Conn., Feb. 17, 1856; d. Philadelphia, Pa., May 27, 1937. Leaving school at the age of 11, he became a printer's apprentice, studied photography on his own, and from 1874 to 1878 directed the photographic laboratory at Cornell University. In the latter year he invented the first practicable halftone photoengraving process, which he applied initially in Philadelphia in 1881; in 1886 he improved the process, which then came into general use. Ives also invented the Kromskop process of color photography (1891) and the later Tripak process (1912), and was a pioneer in the development of motion pictures in color (1914). Among many honors, he received the Rumford Medal of the American Academy of Arts and Sciences (1912). His *Autobiography of an Amateur Inventor* appeared in 1928. See also PHOTOGRAPHY—*Color Photography Processes*.

IVES, Herbert Eugene, American physicist: b. Philadelphia, Pa., July 31, 1882; d. Upper Montclair, N.J., Nov. 13, 1953. Son of the inventor Frederic Eugene Ives (q.v.), he was educated at the University of Pennsylvania (B.S., 1905) and Johns Hopkins University (Ph.D., 1908), and from 1919 to 1947 was a member of the technical and research staff of the Bell Telephone Laboratories. Here he developed the first transmission of pictures over telephone wires (1924) and was in charge of the work which resulted in the first successful television broadcast (1927). Color television was demonstrated later the same year, and two-way television three years after. Ives also invented a moving atomic clock, which measures the motion of electrons; an artificial eye for use in photometry; and a lamp for the production of artificial daylight.

IVES, James Merritt, American lithographer: b. New York, N.Y., March 5, 1824; d. Rye, Jan. 3, 1895. He was born in a cottage on the grounds of Bellevue Hospital, where his father was superintendent. His formal education was slight, and he went to work at the age of 12, but his interest in art was so great that he spent many hours in self-study in galleries and libraries. Ives married a sister-in-law of Nathaniel Currier (q.v.), who in 1834 had established a lithographing business in New York City. In 1852 he was employed by Currier as a bookkeeper, but it soon became evident that he was more than that; he had a keen sense of organization which almost immediately enabled him to qualify as business manager. His carefully acquired knowledge of art was greater than his employer's, and his natural feeling for popular taste was an added value. In 1857, Currier took him into partnership, and the firm name of Currier & Ives began to appear on lithographs.

Ives directed the activities of a large staff of artists, choosing and assigning them. He learned lithography, and it is believed that he actually executed some of the firm's prints himself. His ideas went into many others. He devoted his life

entirely to the business, leaving it once briefly for service in the Civil War as the organizer and captain of Company F of the 23d Brooklyn Regiment. He remained active in the business until his death. See also CURRIER & IVES.

RUSSEL CROUSE.

IVIZA. See IBIZA.

IVORY, ἰῡό-ρι, **SIR James**, Scottish mathematician: b. Dundee, Scotland, 1765; d. London, England, Sept. 21, 1842. Educated at the University of St. Andrews, he was professor of mathematics (1804-1819) at the Royal Military College at Great Marlow, Buckinghamshire (removed to Sandhurst in 1812). In 1809 he read a notable paper to the Royal Society on the problem of the attractions of ellipsoids, presenting the theorem which bears his name. Some of his other major contributions include a method of determining the orbit of comets (1814) and a theory of astronomical refractions (1838). He received the Copley Medal (1814) and two other gold medals from the Royal Society, of which he became a fellow in 1815, and was knighted in 1831.

IVORY AND IVORY CARVING. Ivory is properly a type of dentine present only in the tusks of the elephant, although the term is loosely applied to the tooth structure of the walrus, hippopotamus, whale, and others. "Green" ivory (from freshly killed animals) is easier to work than the more brittle "dead" ivory. African ivory, because of its density, whiteness, and ability to take a polish, is valued in commerce. Asiatic ivory, a chalky white when green (though it yellows quickly) and of coarser grain, was apparently preferred in imperial Rome for the official diptychs (two-leaved writing tablets), as the poet Claudian (c. 400 A.D.) informs us. This preference is confirmed by a carving on the lower plaque of a leaf from the Barberini diptych in the Louvre (Paris), showing Indians bringing elephants' tusks to the emperor. Elephants' tusks average about 50 pounds, but have been known to reach a weight of over 200.

The leading ivory markets of the world are Antwerp, London, and Liverpool. In the West, ivory is used as material for knife handles, the backs of brushes, billiard balls, piano keys, combs, and small ornamental objects. India, China; and Japan supply toys, house models, chess- and checkermen, puzzles, and the like. The diminishing supply of true ivory and increased costs have led to the use of substitutes such as vegetable ivory (q.v.), celluloid, and others.

General History.—Although carving in ivory and bone has been practiced from earliest times to the present, it does not present a continuous development but rather a sequence of "schools," interrupted by barren periods. A notable instance is the period between 600 and 800 A.D., almost totally deficient in extant examples, a deficiency explained in part by the Arab conquests in the Mediterranean Basin, which must have interfered with the normal ivory trade from Nubia and India. The European ivory carver, after the depletion of the elephant herds which once inhabited North Africa and western Asia (elephants were hunted in Syria as late as 1000 B.C.), was dependent upon a remote source of supply. The problem of supply may be a factor in explaining the popularity of morse ivory (walrus tooth) in the Middle Ages, particularly in England.

The suitability of ivory for carving, as well as its rarity, has given it an honored place in the adornment of the palaces of kings and of temples to the gods in all ages. The ancients deemed ivory particularly suitable, either alone or in conjunction with gold (the only metal thought worthy of being combined with it), for the rich inlay of ceilings, for thrones, scepters, horse trappings, and other furnishings, and for sacred objects. Solomon's throne was of ivory overlaid with gold. The hero of Homer's *Odyssey* tells of a marriage bed which he "made fair with inlay work of gold and of silver and of ivory." The Greeks combined gold and ivory for their colossal statues of the gods (called chryselephantine), the flesh parts being of ivory and the draperies of gold. The most famous examples are the seated Zeus at Olympia (one of the Seven Wonders of the World, q.v.) and the Athena (438 B.C.) that stood in the Parthenon, her temple on the Acropolis at Athens, each about 40 feet high, by the sculptor Phidias. In Rome, ivory was lavished on the houses of the rich to such an extent that the poet Horace (65-8 B.C.), to show that he was not wealthy, wrote that neither ivory nor a ceiling of gold glittered in his house.

In the Middle Ages, particularly in Carolingian and Byzantine art, ivory carving assumed an importance far beyond its intrinsic merits. With the almost complete cessation of stone sculpture in the East for religious reasons, ivory carving helped to bridge the gap between late antiquity and the 12th century Romanesque and later revivals. After the 12th century, although much accomplished and charming work was produced (as in France in the 13th and 14th centuries and in Germany and Flanders from the 17th to 18th), ivory carving became a minor art and ceased to have the same significance. Up to the 16th century, ivory carvings seem always to have been colored or gilded, and were often encrusted with jewels or paste and combined with precious metals.

Paleolithic.—The oldest extant carvings in ivory or bone belong to the Old Stone Age. From the caves of France and Spain come a number of

Pape at Brassempouy (French Pyrenees) and are in the museum of St. Germain, France. Among them is a girl's head, carved with grace and delicacy, contrasting with the crudity of the torsos; she has long hair, and her eyes and mouth may have been added with paint. The statuettes seem to antedate the numerous incised renderings of animals and fish, done with great truth to life, carved on reindeer horns and throwing sticks of the same material, which are probably Magdalenian (c. 20,000-12,000 B.C.).

Egypt.—The popularity of ivory in Egypt is shown by such names as Abydos (ivory city) and the island of Elephantine, designated by the picture (hieroglyph) of an elephant. It seems to have been used there for carving as early as 5,000 B.C. Nude female figures (fertility amulets) of various degrees of crudity appear, as well as ivory combs, hairpins, and various utensils, decorated with birds, animals, and men. One of the best early examples is a knife with an ivory handle from Gebel-el-Arak (now in the Louvre), with a battle scene between men of different races carved on one side. Two statuettes from Abydos are veritable masterpieces of art. One, a king of the 1st dynasty (c. 3000 B.C.; British Museum, London), shows an old man bent with age, wearing the crown of Upper Egypt and an embroidered cloak, rendered with a delicacy and truth never surpassed and rarely equaled in later Egyptian art. The other, in the Cairo Museum, portrays the seated figure of King Khufu (4th dynasty, r. 2590-2568 B.C.), builder of the Great Pyramid; despite its small size (5 inches high) it combines grace with royal majesty. From later periods come chiefly decorations on more utilitarian objects such as handles, spoons, and inlays for caskets or furniture, intended for burial in the royal tombs of the New Kingdom (1570-1075 B.C.). Characteristic are the whips and walking sticks from the tomb of Tutankhamen, in the Cairo Museum and The Metropolitan Museum of Art (New York City), and a comb in the Louvre with a falling ibex on the handle.

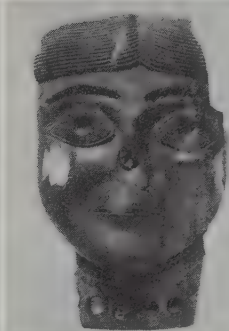
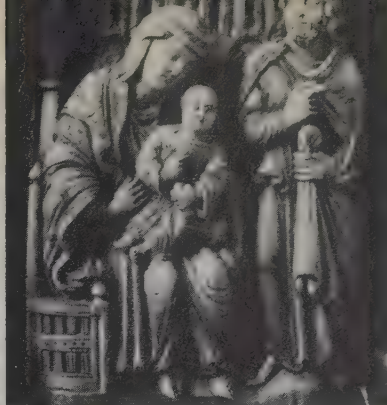
Western Asia (Babylonia, Palestine, Assyria).—Although examples before 2000 B.C. are rare, it is probable that ivory was used in Mesopotamia as early as in Egypt, for ornaments, toilet articles (such as mirror handles, combs, and boxes), and furniture inlays. From the later epoch two remarkable groups of carvings exhibit the skill of the craftsmen. The earlier group (c. 1350-1150 B.C.) comprises a number of carvings from Megiddo (Palestine), Byblos (Lebanon), and elsewhere, which make use of Egyptian as well as Babylonian motifs. Most characteristic, however, is the motif of the crested griffin (possibly Cretan in origin), shown at rest or attacking animals. The second group comes from Assyria and dates from the 9th and 8th centuries B.C. The 50 fine pieces in the British Museum, found about 1845 in the ruined palace at Nimrud (Calah, near Mosul, Iraq), were augmented in 1949-1953 by new finds. The latter include exquisitely carved heads (two of which, one in the Baghdad Museum and the other in the Metropolitan Museum of Art, New York City, 6½ and 5½ inches high respectively), the largest ivory heads from the Near East; boxes inlaid with gold with processions of figures; delicately carved animals of amazing vitality, such as a bull that supported an ivory tray; a cheekpiece for a horse with a seated sphinx and winged cobra of Phoenician style (both in the Metropolitan Museum of Art); and,



Metropolitan Museum of Art, Carnarvon Collection, 1926

A 3,500-year-old ivory gazelle from Thebes. On the base are paintings of characteristic Egyptian desert plants.

statuettes of women, carved of mammoth ivory and thus probably dating from the Aurignacian epoch (c. 40,000 B.C.), when the mammoth still inhabited Europe. A group of torsos with exaggerated breasts and thighs, suggesting their use as fertility symbols, were found in the Grotto du



Leningrad Museum, Bildarchiv Foto Marburg, Metropolitan Museum of Art, The American Museum of Natural History

IVORY AND IVORY CARVING: *Upper left:* Early Christian pyxis with a scene from the story of Jonah. *Top center:* Holy Family group from Cologne, carved about 1175. *Right:* Late 14th century Virgin and Child from France. *Lower left:* Japanese netsuke representing a performing street beggar. *Lower center:* A 17th century French or Flemish statuette of a child with a tambourine. *Lower right:* Assyrian head in ivory with a gold-inlaid necklace, about 715 B.C.

most important, fragments of 16 hinged ivory writing boards (13¼ by 5 inches), the sunken inner portion being scored for wax to provide a writing surface (some wax was preserved). These boards are from the time of Sargon II (r. 721-705 B.C.), and thus provide the earliest known evidence for writing on wax. Some of the objects may be imports from Phoenicia (the Phoenicians being noted for their skill in the craft), but most seem indigenous.

Aegean Basin, Etruria, Greece.—Parallelizing the Megiddo ivories are finds from the Aegean. From Enkomi (Cyprus) is a splendid gaming box (British Museum), carved with hunting scenes, and two mirror handles with combats between men and monsters, one of which (12th century B.C.) shows a man slaying a crested griffin. From Crete (Knossos) come ivory acrobats with loin cloths of gold, the epitome of graceful movement, and the gold and ivory "snake goddess" (6½ inches high; Museum of Fine Arts, Boston, Mass.), who wears a flounced skirt banded with gold, a high tiara pierced for gold attachments, and holds gold snakes in outstretched hands (c. 1500 B.C.). From the Greek mainland, particularly from Mycenae, come a number of ivories. Among them are statuettes of women in flounced garments; a ceremonial scepter (10¾ inches long); models of figure-of-eight shields and columns; and ivory inlays for furniture and caskets, ornamented with such typical Mycenaean motifs and spirals, dolphins, lily and ivy sprays, and running lions attacking calves. Perhaps the most remarkable ivory, found in 1950-1953 at Mycenae, is the

head of a warrior wearing the Homeric boar's tusk helmet (National Museum, Athens), carved almost in the round of solid ivory; it is better preserved and superior to similar heads found in the late 19th century, also at Mycenae.

From classical Greek cities, such as Ephesus and Sparta, come a number of statuettes and reliefs (8th to 7th centuries B.C.), which show affinities to Assyrian art (Nimrud group). Athens yields a unique find, from a single grave, of five statuettes (c. 750 B.C.), each a nude goddess standing erect, hands pressed to sides; they are pure Greek in the sensitive modeling of the youthful female form, precursors of later Greek statues. To the same period probably belong carvings from Etruscan tombs in Italy (for example, the Barberini tomb at Praeneste, modern Palestrina), which, with their processional bands of griffins, centaurs, and the like, suggest Eastern and perhaps Phoenician inspiration.

Until 1939 little was known of the famous chryselephantine Greek statues save literary descriptions. In that year were found the remains of eight such statues (three life sized), buried with other offerings beneath the sacred way leading to the Temple of Apollo at Delphi and dating about 600-550 B.C. Although the latest are a century earlier than the creations of Phidias, the method of construction must have been similar. The core of each statue was of wood, to which was attached by iron nails the gold or silver-gilt drapery with thin bronze sheets as a backing. Hair and ornaments (such as earrings and necklaces) were of gold. Two plaques, also of gold,

with an exquisite design beaten out on a mold (*repoussé*) and made up of friezes of Oriental animals (sphinx, griffin, winged horse), apparently adorned the front of one statue, being fastened by silver nails with gilded, enameled heads. The nude parts (such as face, neck, hands, toes) were of ivory and were attached to the core by wooden rivets, as metal might deface the surface by rusting.

Roman and Early Christian.—The Romans used ivory for all manner of purposes, both secular and religious. Since most extant examples come from the later period (4th to 6th centuries A.D.), when the empire was Christian as well as Roman, the only real distinction that can be made between pagan and Christian examples is in subject and use. Thus an oval pyxis, made from a section of an elephant's tusk, is presumed to be Roman if it is carved with scenes from classical mythology such as Venus and Adonis, Diana and Actaeon, or the Judgment of Paris (Walters Art Gallery, Baltimore, Md.); it probably served as a jewel box for a lady's boudoir. Christian pyxes, on the other hand, show Biblical scenes, particularly those that symbolize life after death or God aiding mortals. Very popular, therefore, are such themes as Jonah saved from the whale (as in a pyxis in the Hermitage, Leningrad, USSR) or Daniel in the lions' den (British Museum and Dumbarton Oaks Collection, Washington, D.C.) from the Old Testament, or Christ's miracles and Passion from the New Testament. A large pyxis (5¾ inches in diameter; 5th century), in the Kaiser Friedrich Museum, Berlin, combines the two, Abraham sacrificing Isaac and Christ seated among his apostles, carved in a fine classical style. From about 500 A.D. are two pyxes, almost identical in style, one pagan and the other Christian, both probably carved in Egypt (Alexandria). The pagan one (Landesmuseum, Wiesbaden, Germany) presents an Isis feast and a Nilotic scene; the other (British Museum) shows the martyrdom and tomb of St. Menas and once probably contained relics from his shrine near Alexandria. Other Christian pyxes were used to contain the Host: two examples are in The Metropolitan Museum of Art, one showing the miracle of the loaves and fishes and the other the holy women at the Tomb; another in the Cleveland, Ohio, Museum of Art depicts Christ raising Lazarus from the dead and other New Testament scenes. Christ throughout is portrayed like a Greek god, beardless, with short curly hair.

The most important Roman ivories are the diptychs (two-leaved writing tablets), particularly those issued by the consuls upon assuming office for presentation to their friends, as they are the only dated ivories of the period. Over 50 are preserved, from a leaf of Probus (Aosta, Cathedral Treasury, Italy), issued in 406 A.D., to the diptych of Justinus (Kaiser Friedrich Museum, Berlin) of 540–541 (when the consulship was abolished), including eight of a single consul, Areobindus (506). The two leaves of the diptychs are fastened together with hinges. The interior is recessed for the insertion of wax for writing with a stylus, and the exterior is carved in relief, usually showing the consul standing or seated on his special chair with name and titles inscribed above, and below a scene from the amphitheater, such as beast fights or acrobatic scenes. The 5th century diptychs, all of consuls of Rome and apparently carved locally, are of Roman style with an occasional attempt at portraiture (for example,

the diptych of Felix 428, in the Bibliothèque Nationale, Paris). The 6th century ones, however, exhibit the frontality and ornateness of the hieratic, "Asiatic" style (Early Byzantine) and seem to have been mass produced in some Eastern city (Alexandria or Constantinople), the inscription to be added when purchased. On a diptych of Anastasius (517; Bibliothèque Nationale, Paris), for instance, the seated consul (repeated on each leaf) is a type, not an individual; the small figures of gladiators at the bottom, however, are treated more freely, resembling those of the pyxes.

The same combination of classical (Hellenistic Greek) and Eastern elements occurs on the imperial five-part consular diptychs (for example, the Barberini diptych, whose Christian origin is revealed by the youthful bust of Christ at the top); the book covers in the Library of the Monastery at Etschmiadzin (Armenia) and in the Bibliothèque Nationale, Paris, with the life of Christ and Mary; and the episcopal chair in the Museum, Archbishop's Palace, Ravenna, Italy, with a monogram referring to Maximianus (consecrated bishop of Ravenna in 546). The chair, made of ivory panels (39 originally, exclusive of borders; 12 missing) on a wooden frame, presents the figures of John the Baptist and the four Evangelists set in niches on the front, and the life of Christ and Joseph on the back and sides, all carved in a lively Hellenistic style; but the vine-scroll ornament that surrounds the figure panels shows the Asiatic interest in abstract design and patterns of light and dark. This chair, undoubtedly the finest ivory of the period, was probably carved about 500 A.D. by Greek artists (perhaps in Alexandria) and later purchased by Maximianus. Closely related in style is a fine plaque (16½ inches high) in the British Museum, with the Archangel Michael standing at the top of a flight of steps and holding a staff and globe; the Greek inscription above, "Receive this gift, and having learned the cause . . ." suggests that the missing leaf with the rest of the inscription may have shown the emperor for whom the gift was probably intended.

A number of Christian carvings, Roman rather than Greek-Asiatic in style, resemble the 5th century consular diptychs (for example, Lampadius, c. 428; Boethius, 487) and the private diptychs, such as one in the Civic Museum, Liverpool, England, with Aesculapius and Hygeia, or the marriage diptychs of the Symmachi and Nicomachi families, Victoria and Albert Museum, London; Cluny Museum, Paris of about 394 (unique in its "refined" Greek style). These Christian carvings include a cover in the Cathedral of Milan in Italy; a plaque in the Bavarian National Museum, Munich, Germany, with the women at the Tomb and the Ascension of Christ; and two rectangular caskets, one in Brescia, Italy (Museo Civico Cristiano), with Old and New Testament scenes on sides and lid (late 4th century), and another in the British Museum with the Passion of Christ, notable in that it presents probably the earliest rendering of the Crucifixion (c. 425). Not only does the style continue the Roman tradition of careful modeling in low relief, but the subjects are also Western in treatment. Thus Christ sits astride the ass in his entry (not sidesaddle as in the East); the Holy Sepulcher is incorrectly shown as a two-storied structure, and so on. The influence of these Western ivories upon later art is shown by another cover, in the Bodleian Library, Oxford,

of the early Carolingian age (c. 800), which is directly copied from a 5th century diptych, two panels of which are preserved (Kaiser Friedrich Museum, Berlin; Louvre, Paris).

Byzantine.—In contrast to the variety of styles of early Christian art is the uniform excellence and high degree of artistic refinement that characterize the ivories of the main Byzantine period (10th to 12th centuries A.D.), after the ban on religious images (726–842) was removed. The rectangular caskets, often decorated with subjects from mythology and therefore for secular use, may have originated during the controversy, when sacred images were forbidden, but most are later, including the one from Veroli, Italy, in the Victoria and Albert Museum, London (10th to 11th century), the best of about 50 known; the panels are attached to a wooden frame and the borders contain rosettes in circles. The most important ecclesiastical objects are diptychs, triptychs (three-leaved alterpieces), and single panels. Possibly transitional in style (7th to 10th century) is a panel in Milan (Castello Sforzesco) with the Annunciation set before sharply receding architecture; Gabriel recalls the Michael of the London plaque, but both he and Mary have become flatter and show less organic articulation.

The characteristic style of the carvings of this period presents a perfect fusion between Greek and Eastern ideas, the former dominant in the classic restraint and insistence upon symmetry. The Greek triangle, for instance, forms the basic design of a panel in Paris (Bibliothèque Nationale), which shows Christ, standing on a high pedestal, crowning the emperor (probably Romanus IV, r. 1067–1071) and the empress. The three figures are set in isolation against a plain background; Christ, long-haired and bearded, is clad in flowing robes that reveal something of the body beneath, but the imperial pair have the rigidity of the Asiatic style. More Eastern in spirit is the famous Harbaville triptych in the Louvre, with Christ enthroned between John the Baptist and Mary in the central panel, the lower portion and the wings being filled with formal rows of apostles and saints. Both, however, transcend reality and transform the ivories into devotional icons for veneration in the church. Even the narrative scenes from the Bible and Apocrypha, although more pictorial than the triptychs, maintain this air of otherworldliness. After the 12th century, Byzantine ivories tend to become careless in execution, dull, and repetitious. More originality occurs in the Russian examples that continue the tradition.

Another group of ivories are of Muslim origin. They include drinking horns (oliphants), usually with hunting scenes and animals set in scrolls, and a group of caskets, carved for the caliphs of Córdoba in the 10th century. Other later caskets seem to have been done in Sicily by Arab carvers.

Carolingian and Romanesque.—In the West from 800 to about 1150 A.D., the monasteries of the Rhineland and northern France developed "schools" of diverging styles. Most are imitative either of early Christian ivories, such as the previously mentioned Bodleian cover, or of East Christian and Byzantine models. An example of the latter is the Lorsch cover in Rome (Vatican), obviously inspired by a 6th century ivory such as the Ravenna chair; curiously enough the lower panel is carved from part of a consular diptych (other examples of "palimpsests," where old carv-

ings are reused, are fairly frequent). More distinctive are the ivories based upon manuscripts, carved in a dynamic linear style. A plaque set in the covers of a psalter of Emperor Charles the Bald (823–877) in Munich (Staatsbibliothek) with an elaborate Crucifixion and Marys at the Tomb (now a three-storied structure), is based upon the pen-and-ink drawings of the Utrecht Psalter (School of Reims); and a panel in the Civic Museum, Zurich, Switzerland, shows an illustration of Psalm 26 which is a literal translation in ivory of the same scene in the Utrecht Psalter.

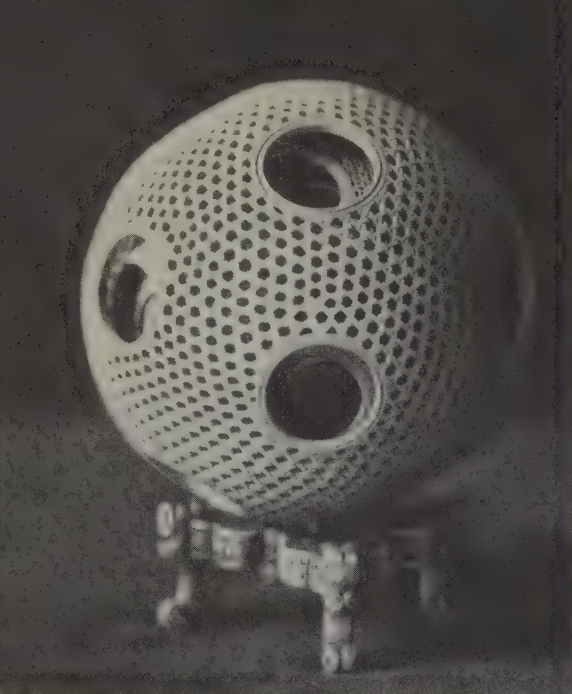


Deane Dickason from Ewing Galloway

One of India's many artists in ivory at work on an intricate statuette of an elephant.

The German cities of Cologne and Metz seem to have been the chief centers of carving in the 11th and 12th centuries. The English preferred morse and whalebone as their material, but a rare instance of the use of elephant ivory occurs in the head of a pastoral staff in the Victoria and Albert Museum (11th century), which shows the ingenuity displayed by the carver in adapting the figures to the shape of the object. The only secular ivories are those of checker and chessmen. An important group of chessmen, of walrus ivory, comes from the island of Lewis, Scotland. The ivory knight (Allen Memorial Art Museum, Oberlin College, Ohio), probably French work of the late 12th century, shows amazing skill in the way the human and animal (horse and dragon) forms have been combined by the artist.

Gothic.—In the 13th and 14th centuries, an age dominated by the cathedral, ivory carving became a minor art. The elaborate architectural frames of diptychs, triptychs, polyptychs (more than three leaves), and small retables, and the graceful, elegant style of the figures in relief or in the round, reflect the influence of the



The American Museum of Natural History

Chinese puzzle ball in ivory. It consists of nine open working balls, one within the other.

dominant art of monumental sculpture in stone. France, and probably Paris, was the center of the art. The statuettes of the period are even finer than the many reliefs that can be seen in various museums, including elaborate portable shrines usually dedicated to the Virgin. To the late 13th century belong two fine groups in the Louvre, of the coronation of the Virgin and the descent from the Cross. Particularly popular are figures of the Madonna, including 20 in the Metropolitan Museum of Art (New York City), the majority from the 14th century. They show Mary either seated with the child in her lap or standing with the baby held high on the left arm. In these statuettes, as in their cathedral counterparts, the hip is outthrust, and the body, enveloped in flowing drapery, takes a graceful curve admirably suited to the curve of the tusk from which they are carved. The hieratic Mary of the Byzantine and Romanesque periods becomes humanized and sometimes even flippant as she smiles at her babe. More reverent than the typical French type, although based upon it, is the statuette in the Cathedral of Pisa in Italy, by Giovanni Pisano (1245-1314). Other religious objects of ivory include croziers, liturgical combs, *flabella* (fans), and *situlae* (holy-water buckets). The most important secular objects are the mirror cases, sometimes showing an elopement (perhaps Lancelot and Guinevere) as in examples in Liverpool (Civic Museum) and New York (The Metropolitan Museum of Art).

Renaissance, Baroque, and Later Periods.—The Italian Renaissance showed little interest in ivory carving, dominated as it was by the major arts of architecture, sculpture, and painting. In the 17th century the Italian baroque sculptor, Alessandro Algardi (1595 or 1602-1654) did some work in ivory, mostly crucifixes, but is better known for his monumental sculpture. The

reputation of his Flemish contemporary Francois Duquesnoy (Il Fiammingo, 1594-1643), who lived in Rome from 1618 until his death, rests largely upon his small sculptures in ivory, bronze, and terra cotta. All manner of statuettes and reliefs with mythological and religious subjects were produced in his studio, so perfectly executed that collectors considered them equal to the works of antiquity. Outstanding are his reliefs of *putti* (cupids), which show the influence of the paintings of Titian and Correggio; his ability to imbue the child form with life and animation and his rendering of delicate nuances and vibrant surfaces in these carvings strongly affected all later representations of children. As the center of ivory carving shifted from Italy to Flanders and Germany, the influence of Il Fiammingo's work appears in the many tankards decorated with bacchanalian scenes, which also owe much to the art of the Flemish painter Peter Paul Rubens, as in the case of the ivories attributed to Lucas Faydherbe (1617-1697), a pupil of Rubens.

In Germany a number of ivory sculptors are known by name. Among them are: Christoph Angermair (d. 1632), who specialized in coin cabinets; Ignaz Elhafen of Nürnberg (fl. about 1650); the Swabians, J. Michael Maucher and Leonhard Kern (17th century), and the Viennese sculptor Mathias Rauchmiller (1645-1686). Most of their work is heavy, ornate, and often lacking in good taste. There is also a plethora of statuettes and reliefs of ancient gods and goddesses, mostly nude, derived from the antique or from manneristic sculptors such as Giovanni da Bologna (1529-1608). The technique of turning ivory on a lathe became popular in Germany in the late 17th and 18th centuries. Johann Martin Teuber of Regensburg wrote a treatise on the subject, and the Zick family of Nürnberg was famous for its production in this field.

In France David Le Marchand (d. 1726) and Jean Cavalier (fl. 1680-1707) specialized in portrait medallions of ivory. As early as the 17th century, Dieppe had a factory that turned out religious objects, such as crucifixes, and continues to produce objects of mediocre quality to this day. Religious objects carved in Belgium, Spain, Italy, and Portugal in the late 19th and 20th centuries have little artistic merit, and the same is true of most carving today.

Orient.—In China ivory was prized next only to jade as a material suitable for fine carving at least as early as the 11th century B.C., in the late Shang dynasty (1523-1027 B.C.), and in the Chou period (1027-256 B.C.) it was used for decorating chariots and furniture, for ritualistic and ceremonial purposes, and even for chopsticks. So great was the demand that the elephant herds which roamed north China were depleted by the 6th century B.C., and ivory had to be imported from Siam, Burma, India, and even Africa. Always prized by the cultured classes, ivory carving was intimately connected with the imperial household as early as the Sung dynasty (960-1279 A.D.), when a special bureau for ivory carvers was established in 1263. In 1680 the Ch'ing emperor, K'ang-hsi, included ivory carving among the ateliers he established for various crafts in the palace precincts and sent for Cantonese workers, famed for their skill in carving intricate patterns and ingenious objects such as the "devil's work balls," consisting of concentric spheres carved one within the other. These are still made today

for the Western market and often have as many as 20 or more distinct balls, the outer being only 4 or 5 inches in diameter.

Except for ivories found in excavations of Shang and Chou sites, characterized by angular geometric designs with the spiral a favorite, most of our knowledge of early carving is derived from written sources. Few extant examples can be dated before the Ming (1368-1644) and Ch'ing (1644-1912) dynasties. Ming carvings of statuettes, particularly of old men (deities, philosophers, scholars), who were preferred as subjects to younger persons, are noteworthy for their mellowness and simplicity and the realization to the full of the beauty of grain and curve of the material. They are always carved out of a single piece of ivory with no added arms or legs. In quality the best of these are equaled only by the finest Byzantine and Gothic carvings. In the Ch'ing dynasty the use of ivory became more widespread; it was employed for a multitude of objects such as fans, screens, elaborate models of palaces and pagodas, toilet articles, and game pieces. Much Ch'ing work is extraordinarily delicate and technically near perfection, but lacks the harmonious beauty of the best Ming pieces.

The earliest ivories of Japan go back to the 8th century A.D. (Imperial Collection, Nara), when a technique known as *bachiru* was practiced, combining stained ivory with unstained designs, which were cut into it (mostly plectra, scabbards, combs, and the like). There is then a gap of about 1,000 years before anything more is known about the art. In the 18th century Yoshimura Shuzan of Osaka introduced or popularized the carving of netsukes in ivory; these ornamental buttons, used to secure cords that are attached to such objects as pipes, sweetmeat or medicine cases, and purses, had formerly been made of wood. It is a genre art of immense popular appeal, with realistic depictions of animal and human forms carved singly or in a variety of combinations. Shuzan, who worked in the early 18th century, was followed by a number of artists who specialized in netsukes and signed their names to them, each tending to concentrate on a particular kind of subject. One preferred cows and oxen, another carved palaces and landscapes in half-opened shells, and a third liked to represent jumping frogs as well as insects and other animals. An example of the extraordinary skill in minute carving exhibited by these artists of the Tokugawa period (1615-1867) is the work of one Nakayama Yamotome of Edo (modern Tokyo), who carved the portraits of 36 famous poets on a single small piece of ivory. A veritable miniature world, carved with infinite skill and patience, is revealed by these carvings.

The local demand for netsukes ceased at the end of the Tokugawa period in 1867, but the opening of Japan to the Western World led to a great demand for netsukes and other objects such as tea caddies, scoops, plectra, and other ornamental pieces. Skilled carving in ivory is done to the present day in Japan, although the product has been commercialized by foreign demand.

Eskimo Carvings.—Although the North American Indian made use of the bones, horns, and teeth of animals (such as bear, beaver, elk) for both useful and ornamental purposes, the craft of working bone and ivory became an art only in the Arctic and sub-Arctic regions of Alaska, northern Canada, and eastward to Greenland and Labrador. Making use of the materials available here but

not further south—the ivory of the narwhal, of the elephant and mammoth (in fossil form) and especially the morse ivory of the walrus—the ancestors of the modern Alaskan Eskimo developed a high degree of skill in engraving designs on such useful objects as harpoon heads, spear shafts, wrist guards and handles for knives, and boxes. The oldest culture is that of the Bering Sea, which apparently extended from St. Lawrence Island, south of Bering Strait, to Point Barrow on the Arctic Ocean and perhaps as far west as the Kolyma River in eastern Siberia, and may be 1,500 years old or more. Characteristic of this art is the freehand rendering of concentric circles with indented centers, curved and straight lines, with spurs attached both to the circles and curved lines. It is a curvilinear art, essentially abstract, with little relation to natural forms, although the indented center of the circle may resemble an eye (particularly when inset with a raised Balen disk), and the objects themselves may take the form of an animal (for example, an ivory seal, 5½ inches long, in the United States National Museum, Washington, D.C.). Even more remarkable than the graceful, flowing character of the incised lines is the uncanny ability of the artist to adapt the designs to the shape of the object. The material is almost always morse ivory, which ranges in color from cream through brown to a dark greenish black, the discoloration being due to long burial in the frozen soil. A masterpiece of this early art is a curious object from Point Hope, Alaska, also in the United States National Museum, consisting of two beautifully carved symmetrical wings and a central body engraved with the usual concentric circles with deep indented centers and other curved and straight lines harmonizing with the shape; the object, 8¼ inches in length, may have been a ceremonial piece to be used in whaling.

A transitional stage between the curvilinear art of the old Bering Sea culture and that of the modern Eskimo, with its heavy conventionalization of natural forms and pictographs, is represented by artifacts found on the tiny Punuk Islands, near St. Lawrence Island, in 1928. They are engraved with dotted concentric circles as before, but these objects are mechanically perfect, indicating the use of a two-pointed metal compass, and cannot therefore be dated before the introduction of European metal via Siberia following the arrival of the Russians in the second half of the 18th century. Straight lines and Y-shaped figures also appear; the incisions are of uniform depth without the subtle variations of the older culture. From the Punuk Islands comes a female figure, 4¾ inches in height, now in the United States National Museum, with a long torso, prominent abdomen, pendant breasts, and short arms and legs, which contrasts sharply with the stiff, conventional dolls of the modern Alaskan Eskimo but recalls similar fertility symbols from Paleolithic Europe.

The Thule culture of northern Canada, Baffin Island, and Greenland seems to be derived from the much older Bering Sea culture, suggesting an eastward migration at some remote time, but the designs on the comparatively few decorated harpoon heads and other objects are much more closely related to the Punuk Islands finds and to modern Eskimo work. Geometric lines, dots, and Y-shaped figures appear, but the circle is absent. We also find the beginnings of crudely drawn but realistic graved representations of animals and

other objects, which lead directly to modern Eskimo art.

Modern Eskimo carving, although often quite skillful, is definitely inferior artistically to the older specimens. Unlike the curvilinear style of the old Bering Sea culture, both engraved designs and shapes are basically representational and realistic. In addition to the objects mentioned, we now find dippers, needlecases, bow drills and drill stands, toggles, buttons, beads, and earrings, game pieces, dolls, and all kinds of household implements made of bone or ivory. Animal and human heads are common as well as geometric designs and pictographs engraved with metal tools. Masks from whalebone, in which the marrow is utilized for the exterior surface, also occur.

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IVORY COAST is a country of west central Africa. It is located on the bulge of Africa on the coast of the Gulf of Guinea, an inlet of the Atlantic Ocean. The country is roughly square in shape and nearly the size of the state of New Mexico. It is bounded on the west by Liberia and Guinea, on the north by Mali and Upper Volta, and on the east by Ghana.

The Ivory Coast is a rolling plateau rising gradually from the south to mountainous regions in the west and northwest. The climate is tropical, with heavy rainfall in the inland forest areas. The country is crossed by the Cavally, Sassandra, Bandama, and Comoé rivers.

Abidjan, the capital, is the principal port and the nation's center for air traffic. The only other sizable city is Bouaké, in the central part of the country.

The People.—The people of the Ivory Coast are mostly Negroes, organized in about 60 tribal groups. Over 60 percent follow tribal religions, 22 percent are Muslim, and 13 percent are Christian. The population includes about 20,000 Europeans, most of French descent.

Illiteracy is widespread among the people, but educational facilities are being expanded. Although only about 40 percent of the school-age children are enrolled in school, this is a higher percentage than in many other African nations. About 1,000 students attend the University of Abidjan.

The Economy.—Almost 90 percent of the people depend for their livelihood on agriculture, forestry, stock raising, or fishing. The principal food crops are yams, cassava, bananas, and taro. In cash crops, the Ivory Coast is the world's third-largest producer of coffee and fourth-largest producer of cocoa. Investments have been directed at the development of other cash crops, mainly cotton and rubber. The lumber industry produces mahogany and other woods for export.

Food processing and palm-oil extraction are the country's principal manufacturing industries. Textile and light-metal industries are developing. Since 1960, scientific mining techniques have increased the production of diamonds and manganese. Industrial growth is hindered, however, by inadequate transportation facilities. Most goods

are still transported by water, although increased funds have been allocated for road improvement programs since 1960.

Republic of the Ivory Coast Form of government: Republic. Area: 127,520 square miles. Population (1962): 3,500,000. Capital: Abidjan, pop. (1962) 185,000. Official language: French. Gross national product (1962): \$520,000,000. Per capita income (1962): \$160. Chief exports (1962): coffee, 142,000 tons; cocoa, 101,000 tons; wood, 915,000 tons. Value of trade (1962): exports, \$194,000,000; imports, \$157,000,000.
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France takes about 50 percent of all exports from the Ivory Coast, and provides about 70 percent of all imports, chiefly food and machinery.

Government.—The government of the Republic of the Ivory Coast was established by the constitution of 1960. The constitution provides for a strong president elected for a five-year term. He holds exclusive executive power, appoints a cabinet which is responsible to him, and may also participate in legislative activities. The legislature is the 70-member National Assembly, elected for a five-year term by universal adult suffrage. All deputies are members of the Democratic Union of the Ivory Coast.

History.—In the 1400's, French sailors began to trade in ivory in the area. In 1637, French missionaries landed at Assinié, and a permanent mission was established there in 1687. The region of Grand-Bassam in the southeast became a French protectorate by a treaty signed in 1842. Later treaties extended the area of French rule and set up permanent boundaries. In 1893 a French governor was appointed, and in 1895 the Ivory Coast became a part of French West Africa.

The Ivory Coast became an autonomous republic in the French Community on Dec. 4, 1958. On Aug. 7, 1960, it was proclaimed an independent republic, outside the Community. Since independence the Ivory Coast, under president Félix Houphouët-Boigny, has maintained close economic and political ties with France.

IVY, i'vī, the name applied to various plants, especially the genus *Hedera*, in the ginseng family, Araliaceae. Of these *Hedera helix*, the English ivy, native of Europe, is best known and most commonly cultivated. *Hedera helix* is an evergreen; in the juvenile state it is climbing, with three- to five-lobed, dark green, leathery leaves, as much as four inches long but usually smaller, often with light-colored veins, and with stems bearing aerial rootlets. The adult form is more shrubby, has entire leaves, lacks aerial roots, and bears small greenish flowers in umbels. The flowers, which appear in autumn, have five sepals, five petals, five stamens, and a five-celled ovary which matures the following spring into a black berry. Like other plants long in cultivation, *H. helix* exists in very numerous varieties; many of these have variegated leaves, marked with white, yellow, or dark colors. English ivy is extensively used as an ornamental on walls, in gardens, in hanging baskets, in greenhouses, and as a ground-cover plant in shaded areas. Most of the varieties do not withstand severe cold. Irish ivy, *H. helix* var. *hibernica*, a widely grown variety, has larger, thinner leaves, somewhat lighter in color.

In the Algerian ivy, *H. canariensis*, the stems and leafstalks are red and the leaves and fruits are larger than in *H. helix*. This species is native of northwestern Africa, Madeira, the Canary Islands, and the Azores. When adult plants of this species are sprayed with gibberellic acid, they revert to the juvenile form, with lobed leaves and aerial roots. *Hedera colchica*, of southeastern Europe and Asia Minor, has green twigs and relatively large leaves.

Many other plants, not closely related to *Hedera*, are also called ivy. Among these are poison ivy (q.v.), *Rhus radicans*; Boston or Japanese ivy, *Parthenocissus tricuspidata*, native of China and Japan, with three-lobed or three-parted leaves turning brilliant red in autumn, the most commonly planted vine on walls and buildings in North America; ivy bush, the mountain laurel (q.v.), *Kalmia latifolia*, of eastern North America; ground ivy (q.v.), *Glechoma hederacea*, a creeping plant with reniform, crenulate leaves and small, purplish-blue bilabiate flowers in early spring, native of Europe and Asia but widely naturalized in North America; Kenilworth ivy (q.v.), *Cymbalaria muralis*, a trailing European plant with small blue flowers marked with yellow; and German ivy (q.v.) *Senecio mikanioides*, a twining South African composite with small heads of yellow flowers.

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IVY POISONING, a contact dermatitis which occurs when there is a direct exposure between the skin of an individual and a member of the *Rhus* genus of plants: poison ivy, poison oak, or sumac. The skin lesion consists of crops of blisters accompanied by redness, burning, and intense itching. The severity of the rash varies with the amount of contact and the individual sensitivity of the patient. The oleoresin or antigen of the poison ivy plant rubs off on the clothing, the fur of animals, and even the skin of the affected individual. Prompt cleansing with soap and water helps eliminate the source of further contamination. However, the watery fluid in the blisters is a serous exudate; it cannot spread the rash, nor can such fluid carry ivy poisoning from one person to another. The skin lesions appear first on exposed parts, hands, feet, or face, and continue to appear from several hours to several days after exposure.

The antigen or the chemical causing the reaction in ivy poisoning has been chemically synthesized and is known as 3 pentadecylcatechol. Various vaccines have been prepared from the poison ivy antigen. These are best given by the intramuscular rather than the oral route and should be given in the late winter before the plants begin to leaf out. Administration of the vaccine to acute cases of ivy poisoning is ill advised and dangerous.

Many treatment agents have been used for poison ivy cases. The first principle involves strict cleanliness and avoidance of further contact. Various drying ointments, lotions (calamine and calamine with phenol) and Lassar's paste (zinc oxide) are used for the less severe cases; wet compress dressings (Burow's solution) for cases where the skin blisters break down and fissure. Since the early 1950's steroid therapy, both locally and orally, has been extremely helpful. Cortisone, hydrocortisone, prednisone, and prednisolone promptly control itching and block further spread. Secondary skin infection is rare

but should be watched for, and appropriate antibiotic therapy begun.

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IWO JIMA, ēwō jēmā, a Western Pacific island, one of the Volcano Islands (q.v.) annexed by Japan in 1891, 760 miles south of Tokyo. It is 5 miles long and 2 miles wide, the area being 8 square miles; the population normally numbers about 1,000. During World War II it was captured by United States forces after heavy fighting. Marines landed on Feb. 19, 1945, attacked Mount Suribachi, a volcano on the south, and raised the American flag on its summit on February 23. Conquest of Iwo Jima was completed by March 16. Marine casualties totaled 19,938, of whom 4,189 were killed; and Japanese dead were estimated to number 21,000. After the war the United States retained control of the island for security purposes.

IXIA, ik'sī-ā, a genus of some 25 species and numerous cultivated varieties of South African plants, one from tropical Africa, in the iris family, Iridaceae. They are propagated by corms, from which the grasslike leaves, often a foot or more long, and the simple or branched stems, one to two feet high, develop. The very attractive spring-blooming flowers, in spikes or racemes, are one to two inches in width, at first erect, later nodding. They have six perianth parts and three stamens and are delicately and variously colored—white, yellow, orange, pink, red, lilac, and green. They can be grown in pots and cold frames, but in northern United States and in colder regions they require protection against frost if planted outdoors.

EDWIN B. MATZKE.

IXION, ik-sī'ōn, in Greek mythology, king of the Lapithae, in Thessaly, son of Phlegyas. He married Dia, daughter of Deioneus. He murdered his father-in-law, and as punishment, became insane until Zeus cured him and permitted him to reside in Olympus. He became enamored of Hera, and attempted to seduce her. Zeus made a cloud in the shape of Hera, and carried it to the place where Ixion had appointed to meet her. Ixion was caught in the snare, and from his embrace with the cloud were born the Centaurs (q.v.). Zeus banished him from heaven; struck him with his thunder, and ordered him tied to a winged or fiery wheel which was to revolve eternally, according to some in the air, and to others in the underworld.

IXTLILXOCHITL, ish-tlil-shō'chit-l, **Fernando de Alva Cortes**, Mexican historian: b. Texcoco, 1568?; d. ?1648. Through his mother, he was descended from the ancient kings of Texcoco, and in 1602 became heir to the family's titles and possessions. The Spanish viceroy, for whom he was interpreter, commissioned him to write histories of the ancient Mexican peoples, of whom he possessed great knowledge. His works remained unknown until their importance was revealed by Francisco Javier Clavijero (Clavijero), and afterward by Baron Alexander von Humboldt. They were deposited in the library of the Jesuits in Mexico. The series of histories consisted of 13 books or relations, many

of which were repetitions of material in earlier volumes, and covered the period from the most ancient times to the destruction of the Mexican Empire. His history of the Chichimecs was first published in Paris in 1840.

IYEYASU. See IYASU.

IZABAL, ē-sā-väl', department, Guatemala. It is in the eastern part of the country. Its capital, chief port, and rail terminus is Puerto Barrios on the Gulf of Honduras. The region produces timber as well as bananas, coconuts, and other fruit. Lake Izabal, formerly called Golfo Dulce, is a body of fresh water about 30 miles long and 15 miles wide, fed by the Río Dulce, and draining through this river and a smaller lake into the Caribbean. In Spanish colonial times, the village of Izabal, on the south shore of the lake, served as a center of trade with the Indians of the interior, but it has since been nearly abandoned. The climate is tropical and humid. Pop. (1950) 55,635.

IZALCO, ē-säl'kō, volcano in the western part of El Salvador. One of the most active in the world, it has been called the Lighthouse of the Pacific. It is believed to have been formed in 1770 by a sudden eruption. Its height, long subject to dispute, is apparently somewhat less than 8,000 feet, but the mountain continues to grow as fresh volcanic matter is disgorged.

IZARD, iz'erd, Ralph, American statesman: b. near Charleston, S.C., 1742; d. there, May 30, 1804. Inheriting a considerable fortune, he was sent to school in England, and, after some years in South Carolina, settled in London (1771). He attempted unsuccessfully to persuade the British ministry to alter its policy in regard to the American colonies, and in 1776 moved to Paris, where, acting for the Continental Congress, he helped to procure ships of war for the American cause. He returned to America in 1780, entered the Continental Congress as delegate from South Carolina, and later became his state's first United States senator (1789).

His son, **GEORGE IZARD** (1776-1828), attained the rank of major general during the War of 1812, at one time holding chief command of American forces on the northwestern frontier. He became governor of the Arkansas Territory in 1825.

IZHEVSK, ē-zhěfsk', city, USSR. It is situated in the western foothills of the Urals, 165 miles east-northeast of Kazan and about 600 miles east of Moscow, and is on the Izh River, a tributary of the Kama. Under the Soviet regime, Izhevsk has been the administrative capital of the Udmurt Autonomous Soviet Socialist Republic, a political division of the Russian Soviet Federated Socialist Republic inhabited by the Udmurt people, an ethnic group of Finno-Ugric stock. The city was founded in 1760 as one of the earliest ironworking centers in the Urals. In the 19th century it acquired fame as a producer of rifles and other small arms.

Izhevsk has since become industrially important for its production of machinery, including machine tools and agricultural implements. The old arms plant was reconstructed after the Bolshevik Revolution and was divided in 1939 into a machine-building plant and a separate steel

plant. In 1933 the Soviet Union's first motorcycle factory was established here. The city is also an agricultural processing center for grain and livestock and has a woodworking industry fed by local timber production. Pop. (1956 est.) 252,000.

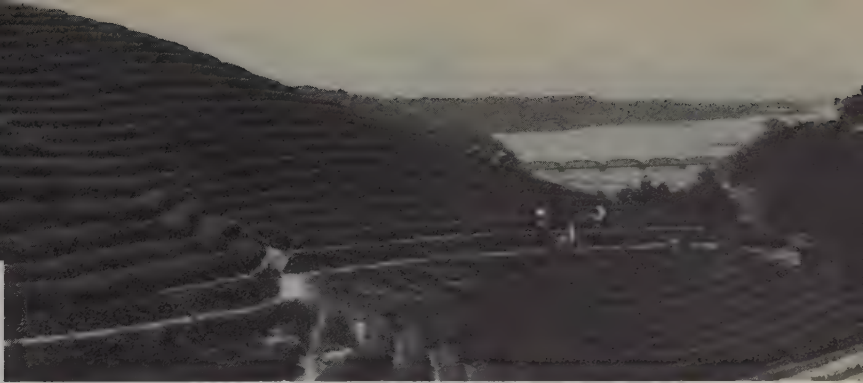
IZMAIL, iz-mä-ēl', city, USSR. It is in the Ukrainian SSR in southernmost Bessarabia, 120 miles southwest of Odessa, in Odessa Oblast (province). It is a port on the northern arm of the Danube River delta, which leads to the Black Sea and forms the Rumanian border of the Soviet Union. Industries include a ship-repair yard and fisheries, and the port serves as the headquarters of the Soviet Danube River naval flotilla. Izmail lies among extensive vineyards and orchards whose products are processed in the city as wine, grape juice, and canned fruit.

A Turkish fortress after the 16th century, Izmail was seized and lost repeatedly by the Russians in their wars against the Turks. The most notable assault was that of 1790, when the fort, garrisoned by 35,000 Turks, was stormed and taken by Russian troops under Aleksandr Vasil'yevich Suvorov. Izmail subsequently shared the fate of southern Bessarabia, passing to Russia in 1809, back to Turkey in 1856, and to Russia again in 1878. From 1918 to 1940 the city was in Rumania and was called Ismail. Its annexation by the Soviet Union in 1940 was confirmed in 1947, and it served for several years as the capital of Izmail Oblast, which was merged with Odessa Oblast in 1954. Pop. (1956 est.) 40,000.

IZMIR, iz-mir' (formerly SMYRNA, smür'-nä), seaport, Turkey; capital of the Vilayet (province) of Izmir. It is approximately 210 miles south-southwest of Istanbul and is situated on the west coast of Anatolia at the head of the Gulf of Izmir. The harbor is excellent and main rail lines bring to it goods from inland cities for export. Manufactures of Izmir include leather, tobacco, soap, dyes, and cotton textiles.

The original city, presumably antedating the colonization of Asia Minor by the Greeks, stood on the northeast side of the gulf. It passed from the Aeolian Greeks to the Ionians of Colophon about 688 B.C. After being captured by the Lydians in 627 B.C., it declined from its former prosperity. The old city was abandoned and a new one constructed on the present site, on the southeast shore of the gulf, shortly after the death in 323 B.C. of Alexander the Great, who is said to have inspired the project. Building was carried out on a grand scale, and the city soon became one of the most prosperous in the world. Smyrna believed itself to be the native city of Homer and its acropolis had a temple where the poet was honored as a god. The city was still prospering in Roman times. It was the home of an important early Christian community and the site of the labors and martyrdom of St. Polycarp.

From the 4th to the 15th century, the city was in the Byzantine Empire, with the exception of two periods when it was briefly held by the Seljuk Turks—once in the 11th century and once in the 14th century. From 1206 to 1261 it was in the Empire of Nicaea. In 1402, Tamerlane sacked the city and massacred the inhabitants. As a city of the Ottoman Empire from 1424 to 1919, Smyrna revived and became the chief port of Asia Minor. Occupied by Greek forces in 1919, it was returned to the Turks by the Treaty of Lausanne in 1923. Pop. (1950) 230,508.



Consulate General of Japan

JAPAN: Plantation in Shizuoka Prefecture, the nation's main tea-growing region.

J, the 10th letter in modern alphabets derived from Latin which have this symbol, but historically only a variety of *i*. It first came into use in scratched inscriptions (*graffiti* on walls or vases, written while the clay or plaster was still wet) as early as the 2d century A.D. Its phonetic value varies enormously. In German it is consonantal (*y*). Latin initial consonantal *i*, however, became a fricative (*j*, as in French *juge*), and the *j* symbol was attached to this sound, which also arose from other sources (French *jour*, Latin *diurnus*). In English it is initially an affricate (*dʒ*, as in *judge*). In Spanish the fricative or affricate has become *h*, strongly aspirated, and written *j* or (before *e* or *i*) *g*. Russian has *z*, written *ж*.

The name of the letter in German is *Iot*, taken from the Semitic name of the *i* symbol. French *ji* (the *ž* sound) was borrowed into English as *jay*. Nearly all modern English words that begin with *j* are loan words, such as *janissary* (Turkish) or *jūjitsu* (Japanese); many are of Romance (mostly French) origin, such as *jaundice*; a few are derived directly from Latin (*Jupiter*); *jurassic* is ultimately Celtic (Jura Mountains); *jūjube* comes from the Near East (through Greek).

The sound *dʒ* is variously written in English: *spinach*, *verdure*, *soldier*, *barge*, *gentle*, *suggest*. In *ldz*, *ndz*, only *lʒ*, *nʒ* are now heard, as in *indulge*, *singe*. Northern dialects in England still preserve *g* in *bridge* (*brig*, formerly *brigge*) and in *singe* have the nasal *ɓ* (Middle English *sengen*). The 18th century *j* in *soldier*, *educate*, and other words is now obsolete, and *ž* not *dʒ*, is heard in *leisure*, *pleasure*. Many authorities regard *j* (*dʒ*) as one phoneme. But although English has the contrast *ch* : *j* (*chain* : *Jane*), it has no initial clusters *sč-* or *dj-* as it has *sp-* and *dr-*. It is better, therefore, to consider the English *j* as a compound phoneme, made up of *d* plus *ž*.

See also ALPHABET.

JOSHUA WHATMOUGH.

JABALPUR. See JUBBULPORE.

JABBOK, jāb'ök (Ar. WADI ZERQA), river, Jordan, rising near Amman and flowing generally west for 80 miles to empty into the Jordan River about 20 miles north of the Dead Sea. In ancient Palestine it was a boundary line between the Amorite kingdoms and the land of Bashan. It was on the south bank of the Jabbok that Jacob wrestled with the angel (Genesis 32:22-32).

JABIRU, jāb'ī-rōō, a handsome stork (*Ephippiorhynchus senegalensis*), also called the saddle bill, of tropical Africa, ranging from Senegal and the Sudan south to Cape of Good Hope Province. It stands over four feet high, and is conspicuously black and white with a sharp, bright red bill about one foot long, encircled by a broad black band and covered at the base by a large bright yellow shield. The legs are black with bright red joints and feet. It inhabits swamps or the margins of rivers, and feeds, as do all storks, chiefly on small aquatic animals or large water insects. The jabiru is also the name applied to one of the New World storks (*Jabiru mycteria*), which ranges from Mexico to Argentina. It is one of the largest flying birds of the New World.

CHARLES VAURIE.

JABLONEC, yā'blō-něts (Ger. GABLONZ), a town, Czechoslovakia, in northern Bohemia, in the Sudeten Mountains, near the Polish border. Jablonec is situated six miles southeast of Liberec, on the upper Neisse River. It is a center of the Bohemian glass industry, specializing in beads, bangles, and artistic glass figures. The name of Jablonec has become identified with imitation jewelry made there. The glass industry developed after the Napoleonic Wars and long supplied an export trade to Africa and Asia. Jablonec also has textile mills (woolens and cotton goods). There are Gothic and 17th century churches and a museum with a large collection of Bohemian cut glass. The town, inhabited once by Sudeten Germans, was virtually depopulated when they were expelled by Czechoslovakia after World War II. Its population was replenished by Czechs, but remained under the prewar level. Pop. (1958 est. 26,000).

JABORANDI, jāb-ō-răn'dī, a common name for plants of the genus *Pilocarpus* in the rue family (Rutaceae), containing about 20 species of shrubs or small trees of tropical and subtropical America. Dried leaflets of various species of *Pilocarpus* were once official as the drug *pilocarpus* or *folia jaborandi*. Several alkaloids are derived from jaborandi leaves, principal among them being *pilocarpine*, used chiefly as a sudorific or myotic. The most important species of jaborandi are the Brazilian *P. microphyllus* and *P. jaborandi*. Less significant is *P. pennatifolius* of Brazil, Paraguay, and Argentina. These plants have compound leaves with several leaflets and greenish or deep rose flowers in elongate clusters.

JOHN W. THIERET.

JACAMAR, jāk'a-när, a bird of the family Galbulidae, which comprises 14 species inhabiting the American tropics from southern Mexico to Brazil. Their closest relatives are the puffbirds and toucans. The majority are the size of a starling, and all are very beautiful, usually glossy bronze green above, and cinnamon, brownish, or black below, with a white throat. They are found along the edge of the high forest, in sites that overlook grassy fields or meandering streams, and nest in a deep burrow excavated in a bank of earth. Jacamars are noted for being very stolid, perching for long periods very quietly on some favored post and sallying forth now and then after some flying insect.

CHARLES VAURIE.

JAÇANA, zhä-sä-nä', a group of birds (Jacanidae) related to the rails, and remarkable for the extraordinary length of their toes, which are further extended by long slender claws. There are four genera and about seven species of jaçana, most of which inhabit Africa, India, and Australia. The genus *Jacana* is American, and one Mexican species (*J. spinosa*) occasionally reaches Texas. The beak is ploverlike and the bend of the wing bears a stout and acute horny spur; the plumage is of a rich purplish brown with the wings green and black. The great spread of the toes enables these birds to walk with ease on the floating leaves of water lilies and similar plants, otherwise their habits are much like those of rails.

JACARANDA, jāk-ä-rän'dä, a genus of about 40 species of tropical American shrubs and trees of the bignonia family (Bignoniaceae). Several species are cultivated as ornamentals and a few yield useful timber. *Jacaranda acutifolia* is a popular flowering tree in Florida and southern California. *J. copaia*, the most widely distributed species, ranges from British Honduras south to Brazil. Its wood is called caroba and is used for matchsticks, boxes, coffins, interior finish, and general construction. Typically, members of *Jacaranda* have opposite, fernlike leaves with many small leaflets; showy, blue or violet, clustered flowers; and woody capsules containing winged seeds. Some species shed their foliage before coming into flower. The wood known as jacarandä or Brazilian rosewood is derived from *Dalbergia nigra*, a Brazilian tree of the legume family (Leguminosae).

JOHN W. THIERET.

JACCOUD, zhä-kōō', François Sigismond, French physician: b. Geneva, Switzerland, Nov. 20, 1830; d. Paris, France, April 27, 1913. He was educated in Geneva and Paris; became professor of pathology in Paris in 1876 and professor of clinical medicine there in 1883. In 1877 he was elected member of the Academy of Medicine and became perpetual secretary thereof. He made investigations of the causes of albuminuria; described prominence of the aorta in the region of the suprasternal notch as symptomatic of aortic dilatation; and was also known for his description of a type of fever in tuberculous meningitis, with irregular, slow pulse, called Jaccoud's dissociated fever. He wrote *De l'organisation des facultés de médecine en Allemagne* (1864); *Leçons de clinique médicale* (1867-1888); *Traité de pathologie interne*, 7th ed. (1883); and *Du froid comme cause de pneumonie* (1887). He was editor of

Nouveau dictionnaire de médecine et de chirurgie (1864-1886).

JACK, jāk, an apparatus for raising heavy bodies and for moving machinery. See HYDRAULIC CRANE.

JACK, or **JACK TREE**, a tropical tree (*Artocarpus integra*) of the mulberry family (Moraceae) that is related to the breadfruit tree and bears the large and well-known jack fruit. The tree is native to India but is planted throughout the tropics. Jack fruits are 1 to 3 feet long, 6 to 20 inches wide, pear- or barrel-shaped, and greenish-yellow to brownish when ripe. The skin is studded with sharp conical warts. The fruits, borne on the trunk and main branches (or in some varieties even on the roots), may weigh as much as 80 pounds. They contain a large number of seeds, each enclosed in a gelatinous sheath. When green, the fruit is used as a vegetable or made into pickles; when ripe, it is eaten fresh or preserved in syrup. The seeds are eaten after boiling or roasting. The tree produces a light brown wood used for furniture, brush backs, musical instruments, and turnery.

JOHN W. THIERET.

JACK AND JILL, the first words of an old nursery rhyme, of considerable folklore interest. Jill is a corruption of the French Julienne, once common in England under the form Gillian. It also appears in the legend of Saint Kilian (Cilian), where Geilana vindictively causes the good bishop's death. This incident of Jack and Jill is probably based on one of the moon myths of Scandinavia. The Norse peasant sees in the spots on the moon the two children rescued by the moon from their father, who had forced them to draw water all the day.

JACK AND THE BEANSTALK, an English nursery tale relating to the heroism of a boy. Its analogue occurs in many national folklore legends. It is supposed to represent in a figure the restoration to the earth of those fertilizing and elemental activities, which are necessary to human life. The harp is the wind, which drives the ships and turns the mills to grind the wheat. The bags of treasure are the raindrops that scatter wealth and plenty. The red hen is the sun that brings life to birth by its fostering heat. The story is enjoyed by young children, however, without reference to the symbolism, simply because of the narrative suspense.

JACK HORNER, the first words of an old nursery rhyme. The rhyme is said to be based on a historic fact. Horner was the messenger whom the abbot of Glastonbury sent to Henry VIII with the deeds of certain manors involved in the dissolution of monasteries. Horner obsequiously handed the parcel to the royal spoliator, but first of all managed to abstract the deeds of the manor of Wells, a "plum" indeed, and the abbot was afterward punished on the charge that he had withheld them.

JACK-IN-THE-PULPIT, or **INDIAN TURNIP**, a perennial herb (*Arisaema triphyl- lum*) of the arum family (see ARACEAE), so called from its spadix, which is upright, with the spathe surrounding and arching over it, suggesting a preacher in an old-fashioned pulpit

with a sounding board. It is common in the United States, east of the great plains, in damp shady woods, and is easily grown in moist garden soil. The spathe falls away in early summer. By late summer the berries which form a dense ovoid head become a brilliant, waxy scarlet. Its acrid tuber or corm is valued for its medicinal properties.

JACK RABBIT. See HARE.

JACK THE GIANT KILLER, the hero of an English nursery story, which reflects triumph of skill over strength and bulk such as makes the point of the story in David and Goliath, or Ulysses (Odysseus) and Polyphemus. The English form is based upon the legend that Saint Michael's Mount, in Cornwall, was once the fortress or castle of a giant, who was dislodged by the valor of an English knight. In adapting the story so as to claim the sympathies of children, the knight is made to take the shape of a child.

JACKAL, a small active wild dog or wolf of the warmer regions of the Old World, found in southeast Europe, Africa, Syria and southern Asia. The common jackal averages about 2 or 2½ feet in length and about 14 inches in height, with a bushy tail about 8 inches long. The eyes are small and the pupil is round. The general color of the body is a dirty yellow or brown, lighter on the throat and belly. Jackals inhabit holes and burrows whence they come forth in the evening to hunt in packs. Their cry consists of a series of prolonged howls, followed by shorter yelps, much like that of the American coyote. The jackal subsists largely upon carrion, often that left after the repast of the fiercer and larger Carnivora; but it also kills prey for itself, a pack hunting down antelopes, deer or other animals, besides getting much small fare, as mice, lizards, insects, and the like. They also eat certain kinds of vegetable food, and sometimes they do considerable damage to sugar and other plantations. The jackal is susceptible of being tamed, but its odor makes it by no means a desirable domestic animal. It is believed to be exceedingly cunning, and in many Eastern tales, especially among the people of India, plays exactly the same part as the fox does in those of Europe. It is probable that jackals have contributed frequently to the commingled stock represented in our domestic dogs, some of which betray very jackal-like points. They interbreed with domestic races.

The common jackal (*Canis aureus*) is the most widely distributed species; but another species, found mostly in eastern southern Africa, is the blackbacked jackal (*C. mesomelas*). This latter form has the back and end of the tail black, the other parts mostly red or yellowish-red. A third species of jackal found in South Africa is the canduc (*C. adustus*), marked by a light stripe on the sides.

JACKASS KINGFISHER, or **LAUGHING JACKASS**, the name of a large inland kingfisher (*Dacelo gigas*) of Australia, given by the colonists in allusion to its loud, hoarse cry. It is about 17 inches long, brown in general color, does not frequent water or catch fish, but lives on insects, small reptiles, etc., and lays its eggs in a hole in a tree.

JACKDAW, a small, black European crow (*Corvus monedula*), with black legs and feet and grayish neck. They inhabit towers, spires and like elevated situations, and even in towns and populous cities are present and breed freely. The nests and eggs are like those of other crows (q.v.) which they resemble in general habits.

JACKS, jåks, **Lawrence Pearsall**, English educator and editor: b. Nottingham 1860; d. Feb. 23, 1949. He was educated at University School, Nottingham, University of London, Manchester College, Oxford, Göttingen University, and Harvard University. He was professor of philosophy in Manchester College, Oxford, dean of the college and warden of residence, 1903-1915, and principal, 1915-1931. He was editor of the *Hibbert Journal* from its foundation in 1902 until he retired in 1947. He is the author of *Mad Shepherds and other Human Studies* (1910); *From the Human End* (1916); *Philosophers in Trouble* (1916); *Life and Letters of Stopford Brooke*, 2 vols. (1917); *Heroes of Smokeover* (1926); *Constructive Citizenship* (1927); *My Neighbour the Universe* (1928); *The Inner Sentinel* (1930); *The Education of the Whole Man* (1931); *Education through Recreation* (1932); *My American Friends* (1933); *Elemental Religion* (1934); *Revolt against Mechanism* (1934); *Co-operation or Coercion* (1938); *The Stolen Sword* (1938); *The Last Legend of Smokeover* (1939); *Construction Now* (1940); and *The Confession of an Octogenarian* (1942).

JACKSNIPE, also called grass or meadow snipe, which is in reality a sandpiper, named in books the pectoral sandpiper (*Tringa maculata*). The perversion of names is due to its somewhat gamelike habits of lying to a dog and flushing correctly from the grass, like a true snipe which render it an attractive object of pursuit; besides which, in the fall it becomes very fat, and it is then excellent eating.

The English jacksnipe is a true snipe (*Limnocyrtus gallinula*) of very small size, and therefore also known as "half-snipe." See also SANDPIPERS.

JACKSON, Abraham Valentine Williams, American Indo-Iranian scholar: b. New York, Feb. 9, 1862; d. there, Aug. 8, 1937. Graduated from Columbia in 1883, he was fellow in letters there (1883-1886), and, after study at Halle (1887-1889), instructor in Anglo-Saxon and the Iranian languages (1889-1891), and adjunct professor of English language and literature (1891-1895). From 1895-1935 he was professor of Indo-Iranian languages and public lecturer at Columbia. By way of recognition of the instruction given by him in their ancient books, the Parsees made to the Columbia library the gift of an important manuscript collection of Zoroastrian works. He appeared also as a public lecturer, became one of the directors of the American Oriental Society, and in addition to numerous contributions to the *Journal* of that society and other learned periodicals, wrote *A Hymn of Zoroaster*, *Yasna XXXI* (1888); *An Avestan Grammar* (1892); *An Avestan Reader* (1893); *Zoroaster, the Prophet of Ancient Iran* (1899); *Persia, Past and Present* (1906); *From Constantinople to the Home of Omar Khayyam* (1911); with A. Yohannan the *Descriptive Cat-*

ologue (1914) of the collection of Persian and other manuscripts presented to The Metropolitan Museum of Art (New York City) by Alexander S. Cochran.

JACKSON, Alexander Young, Canadian painter: b. Montreal, Quebec, Canada, Oct. 3, 1882. Educated in the Montreal public schools, he worked for a time in the lithographic business and studied art in Montreal, Chicago, and at the Julien Academy in Paris. In World War I he served with the Canadian infantry and later as official artist for Canadian war memorials. About 1919 he joined the "Group of Seven," Canadian painters who found inspiration in the wild Canadian northland for the development of a national art. Jackson is noted for his Canadian landscapes, especially from northern Ontario and Quebec, some as far north as Ellesmere Island. Among them are *Night*, *Georgian Bay* and *Early Spring, Quebec*. See also CANADA—31. *Art and Architecture* (Painting).

JACKSON, Andrew, 7th president of the United States: b. Waxhaw settlement, S.C., March 15, 1767; d. The Hermitage, near Nashville, Tenn., June 8, 1845. His parents were



Brown Brothers

Andrew Jackson.

Scotch-Irish immigrants who had come to the Waxhaw settlement with two elder sons to try their fortune. An untimely accident caused the death of Jackson's father about two weeks before Andrew's birth, and through the first 14 years of his life he was reared by his mother, who was given asylum in the home of her brother-in-law.

During this period Jackson became indoctrinated with the virtues and vices of the frontier; he was strong willed, independent, and courageous, and was also noted as a bully, drinker, and swearer. He had little opportunity for formal schooling and no love for it.

The Revolutionary War was a turning point in Jackson's life. In 1779 his eldest brother died in the war. Jackson volunteered at the age of 13, with his surviving brother, and both were captured by the enemy. In the course of his captivity Jackson refused to shine the boots of one of his captors and received for his impertinence a saber slash, leaving a mark which he bore the remainder of his life. While prisoners, the brothers contracted smallpox. On their mother's plea, their illness and youth won them a release, but Andrew's brother died of the disease. A few months later his mother died while serving as a volunteer nurse for the American prisoners held by the British. Jackson was left with a dislike for the British which was to influence him for the remainder of his life.

Early Career.—The experiences which Jackson had undergone brought him to an early maturity. At 14 he had ceased to be dependent upon his uncle, and he tried his hand unsuccessfully at the frontier trades of saddle making and school-teaching. Subsequently he visited Charleston, making some acquaintances in aristocratic social circles, establishing a reputation as a dandy and a gambler, and acquiring an interest in law. After almost three years of study in the law offices of Spruce Macay in Salisbury, N.C., Jackson was admitted to the bar in 1787 and began to practice in Martinsville. He was rescued from the monotonous, hand-to-mouth existence of an unimportant frontier lawyer by the exciting prospects of a visit to the infant town of Nashville, in the Western District of North Carolina (now Tennessee).

Jackson arrived in Nashville in 1788 and quickly found his services in demand. His courage, character, and strong passions were attributes as valuable to the young lawyer as his meager legal training. Jackson developed a profitable practice, and in 1789 was officially appointed prosecuting attorney for the district. His popularity and influence increased rapidly.

At this time Jackson became acquainted with Rachel Donelson Robards, who was unhappily married to Lewis Robards. The storms of this marriage contract had created an unhappy situation which Jackson's appearance did nothing to calm. Rachel finally fled her mother's Nashville home to find a haven in the Natchez country. When news reached Nashville of an alleged divorce granted to Robards by the Virginia legislature, Jackson journeyed to the Natchez country, with the Donelsons' blessing, to make Rachel his wife. The subsequent marriage in August 1791 was deemed illegal when it was learned that Robards had not secured a divorce. Therefore a second ceremony was performed in 1794 after the formal divorce had been granted. The legal niceties had been observed, but the slanders which derived from this unhappy incident were to involve Jackson in many controversies.

Jackson was a member of the Tennessee constitutional convention (1796) and the first representative of the state to Congress (1796-1797). He was then elected to fill an unexpired term in the United States Senate, but gave up this post in 1798 to devote himself to his private affairs.

However, Jackson was thwarted in his desire to return to private life by his election to the Superior Court, at that time the highest tribunal in the state (1798). He did not seek the post, but accepted it on the basis of his favorite maxim, as paraphrased by James Parton, "that the citizens of a free commonwealth should never seek and never decline public duty." The six years he spent as a judge seem to have been among the most pleasant of his life. There are no records of his decisions, but according to Parton, "Tradition reports that he maintained the dignity and authority of the bench, . . . and that his decisions were short, untechnical, unlearned, sometime ungrammatical, and generally right."

Jackson's public services constituted an almost continuous stumbling block for him in establishing his economic independence. In 1804 he resigned from the bench in order to recoup his fortunes. At about this time he was forced to sell his home at Hunter's Hill to pay his debtors, and contented himself with a less pretentious establishment at The Hermitage, a few miles northeast of Nashville. A foray into the mercantile business proved unprofitable, and a few years later the firm closed its doors. Jackson then devoted himself to his plantation, frontier land deals, horse breeding, and horse racing.

One of the most tragic incidents in Jackson's career was his feud with Charles Dickinson, a lawyer trained at the College of William and Mary in Virginia. Dickinson had established a good professional reputation in Nashville. He first aroused Jackson's ire when, in a drunken brawl, he made some personal remarks about Mrs. Jackson. Although Dickinson apologized, relations between the two men remained cool. Dickinson was one of the chief losers to Jackson in betting on horse races. Subsequently false rumors were set afloat which led in 1806 to a duel between the two men. In the duel Jackson killed his opponent and suffered a wound that was to plague him for the remainder of his life. The affair was proper under the frontier code, but it contributed to Jackson's reputation for quarrelsomeness and vindictiveness and failed to quiet the ugly stories that marred his life.

War of 1812.—In 1802, Jackson had been chosen for the coveted office of major general of the Tennessee militia. Early in the War of 1812 he was ordered to lead the militia to the support of Gen. James Wilkinson in New Orleans for a projected campaign against West Florida. Wilkinson did not want Jackson in his command, but he did want the Tennessee militia. He therefore contrived to have the federal government order the disbandment of Jackson's force at Natchez, where it was encamped, hoping the penniless soldiers would be forced to enlist in his army. Jackson refused to disband the troops and pledged his personal fortune to provide for their return to Tennessee. His concern for the welfare of the militiamen and his readiness to share their privations won for him the sobriquet "Old Hickory."

A few months later (August 1813) the massacre by Creek Indians at Fort Mims in the Mississippi Territory resulted in orders to General Jackson to punish the Creeks. In spite of almost incredible hardships, an incompetent and inefficient commissary, and the constant threat of mutiny and desertion, Jackson crushed the Creeks in a brilliant campaign climaxed by the victory at Horseshoe Bend on March 27, 1814. This campaign established Jackson's military reputation,

and he was made a major general in the United States Army with command of the 7th southwestern Military District.

The British plan, which unfolded in the late fall of 1814, was to gain control of the lower Mississippi River valley. Jackson was soon convinced that the major theater of action would be New Orleans, and he concentrated the available troops in that area. After three preliminary skirmishes, the British launched an attack against Jackson's defenses on Jan. 8, 1815, not knowing that a peace treaty had already been signed. The British loss was more than 2,000 while the Americans lost fewer than 100 men. This was the brightest American military achievement of the war, and though it had no influence on the peace settlement, it made Jackson's name a household word and paved the way for his elevation to the presidency.

Florida: 1817-1818.—United States citizens on the Florida frontier were frequently harassed by Indians and outlaws who had found an asylum in the two Spanish provinces. The conditions became so bad that John C. Calhoun, the secretary of war, ordered Jackson to Georgia in December 1817, with instructions to "adopt the necessary measures to terminate . . . [the] conflict." Jackson envisioned the occupation of Florida and its annexation to the United States, and he thought he had the tacit approval of the administration for the measures necessary to accomplish this purpose. He occupied the Spanish forts at St. Marks and Pensacola (April-May 1818) and captured a number of prisoners, including British citizens Alexander Arbuthnot and Robert Christy Ambrister, who were executed. Jackson's high-handed acts were effective and popular, but they brought the country to the verge of war with Great Britain and Spain. The cabinet of President James Monroe handled the diplomatic situation successfully, but Jackson's later relations with Calhoun, John Quincy Adams (then secretary of state), and William Harris Crawford (secretary of the treasury) were strongly influenced by the incident. Jackson always contended that the subsequent purchase of Florida was a complete vindication of his actions. In 1821 he was governor of the Florida Territory for a few months, and later served part of a term in the United States Senate (1823-1825). These activities kept him in the national spotlight but did not contribute any special achievements adding luster to his name.

Presidency.—Jackson was a contender for the presidency in 1824 against Adams, Crawford, and Henry Clay. He received 99 of the 261 electoral votes, 15 more than Adams; but since none of the candidates had a majority in the electoral college, the contest had to be decided by the House of Representatives. The influential Clay, who was serving as speaker of the House, supported Adams, and the New Englander was chosen. Adams then named Clay as his secretary of state. Jackson and his partisans professed to see in this appointment the fulfillment of a bargain, and they began immediately to prepare for the next campaign. So successful was their strategy that in 1828 they won 178 of the 261 electoral votes. Jackson's joy over his political triumph was tempered by the death of his wife on Dec. 22, 1828. He always felt that her death was hastened by the scandalous stories which were circulated during the campaign.

The inauguration of President Jackson was the

occasion for a demonstration of the new spirit that was to pervade national affairs. Hundreds of visitors crowded Jackson's quarters at Gadsby's Hotel, where all were welcomed. Jackson refused to pay the customary courtesy call on the retiring president, holding Adams indirectly responsible for his wife's death. Adams left Washington before the inauguration, and precedent was broken in that the two men did not ride to the Capitol together. Daniel Webster and others reported that they never saw such a crowd before. There was overwhelming evidence that the new administration had enthusiastic popular support.

Jackson's election represented a triumph for the masses of the people and the new West. He was the first president from west of the Alleghenies, and he embodied to a great degree the hopes and aspirations of the West and the common man. He believed that good, honest men could fill the public offices, and he approved the removal of a large number of officeholders and the appointment of his followers to their places. In this way the spoils system was introduced into the federal government. Jackson depended for advice upon a group of personal friends, who became popularly known as the "kitchen cabinet." His own political views only gradually unfolded as the exigencies of national affairs brought problems to his attention.

Eaton Affair.—One of the first of President Jackson's problems was only indirectly connected with administration affairs, but it resulted in the dissolution of his cabinet, a cooling of relations between him and Vice President Calhoun, and the crowning of an heir apparent, Martin Van Buren. In January 1829, Senator John Henry Eaton of Tennessee, who had been named secretary of war, married Peggy O'Neale Timberlake, daughter of a Washington tavern keeper and widow of a United States naval officer. The reputation of Mrs. Eaton was questionable. Jackson became the champion of her virtue and strove to force her on social circles in Washington, but his threats were of little avail. Martin Van Buren, the secretary of state, being a widower and thus free from marital restraint, won increasing respect from Jackson because of the numerous courtesies he showed Mrs. Eaton. Calhoun's wife, on the other hand, was a leader of the anti-Eaton forces. The social freeze continued until Eaton resigned from the cabinet in April 1831 and the president reorganized his official family. The friendship that had existed between Calhoun and Jackson was strained, and the way was opened for an irretrievable break.

Nullification.—In the meantime, important affairs of state were demanding attention. In May 1830, Jackson's veto of the Maysville Road bill revealed that he was determined to protect the Treasury against the growing demand for funds to build canals, roads, and other internal improvements. More critical was the widespread dissatisfaction in the South with the federal protective tariff. This dissatisfaction was most extreme in South Carolina, which had a group of talented political leaders, headed by Vice President Calhoun. In January 1830, Robert Young Hayne of South Carolina, in a series of Senate debates with Daniel Webster, upheld the principle of state sovereignty and the power to nullify federal laws (see NULLIFICATION). The question uppermost in the minds of the citizens was which theory Jackson would support. The president kept his counsel, but a great public dinner on April 13,

1830, the anniversary of the birth of Thomas Jefferson, gave him an opportunity to offer the toast, "Our Union! It must be preserved!" Isaac Hill, a member of the kitchen cabinet, remarked, "A proclamation of martial law in South Carolina and an order to arrest Calhoun where he sat could not have come with more blinding, staggering force." Immediately after this incident the president received information that Calhoun, while secretary of war in Monroe's cabinet, had favored arresting Jackson for his actions in the invasion of Florida. Calhoun's inability to explain this position brought about the final break.

The Tariff Act of 1832 did not provide acceptable relief for South Carolina, and a state convention in November of that year declared the tariff acts null and void in the state, forbidding their enforcement there after Feb. 1, 1833. Calhoun was elected to the Senate in December, in order that he might have a more effective stage for the leadership of the movement, and he resigned from the vice presidency. Jackson met the nullification ordinance with a proclamation of his own (Dec. 10, 1832). He said, "I consider, then, the power to annul a law of the United States, assumed by one State, incompatible with the existence of the Union, contradicted expressly by the letter of the Constitution, unauthorized by its spirit, inconsistent with every principle on which it was founded, and destructive of the great object for which it was formed." Jackson ordered the military and naval forces prepared for any contingency. It appeared that civil war was inevitable.

The crisis was averted by the reopening of the tariff discussion in Congress, resulting in the passage of a compromise tariff law sponsored by Clay, accompanied by a Force Bill authorizing the use of the military to collect government revenue (March 1833). South Carolina had won protection for her interests, and the strength of the federal government had not been impaired. Jackson won the acclaim of the nation as a strong nationalist.

Bank of the United States.—The second Bank of the United States had been chartered in 1816 for a period of 20 years. The power of the bank over currency made it unpopular in the South and West, though Jackson's followers were by no means united in opposition to it. President Jackson at no time had been friendly toward it. He distrusted its power and doubted whether it was constitutional. In addition the bank had, he felt, used its influence against him in the presidential campaign. Nicholas Biddle, the bank's president, encouraged by Jackson's political enemies, decided to ask for a renewal of the charter prior to the election of 1832. It was thought that this move would be embarrassing to Jackson and might cost him his re-election. The bill providing for the recharter passed Congress on July 3, 1832, without difficulty, but Jackson vetoed it with a message that indicated no compromise, and Congress failed to override the veto.

The renewal of the bank's charter was the principal issue in the campaign of 1832. Clay, the National Republican candidate, endorsed its renewal, while Jackson opposed it. The Democrats accused the bank of attempting to influence the voters by calling in loans to state banks and contracting the currency. The underlying difference of opinion came between the merchant, manufacturing, and financial classes on one hand and the laboring and agrarian classes on the other. The

former feared the democratic upheaval, while the latter gave hearty approval to Jacksonian democracy. When the election was over, the president had received 219 of the 286 electoral votes cast.

Jackson took the decisive vote as an endorsement of his veto and made plans to bring about the gradual decline of the bank. He decided that government funds would be withdrawn, and that no more would be deposited in the bank. An order was issued that all receipts after Oct. 1, 1833, were to be deposited in the Girard Bank of Philadelphia and 22 other designated state banks. These became known as "pet banks."

Jackson's policy was bitterly criticized. In the Senate, a hostile majority led by Clay, Calhoun, and Webster passed a resolution of censure (1834), and it was not until 1837 that Jackson's partisans were successful in expunging the resolution from the records. The destruction of the bank was one of his greatest political triumphs.

Specie Circular.—Speculation was a major economic problem during Jackson's presidency. The public debt had been paid, and there was an abundance of free capital to be invested. Especially in the sale of public lands the speculative spirit was evident. In payment for land purchases the government received an assorted collection of bank notes of doubtful value. Restrictive measures proved unsatisfactory, and Jackson felt it necessary to issue the Specie Circular on July 11, 1836. The order required that payment for public lands be made in gold and silver, thus adding to the difficulties of the banks, especially in the West, where bank notes were plentiful and specie was scarce. The circular has often been cited as one of the contributing causes of the panic of 1837.

Foreign Relations.—Jackson's presidency was a period of relative tranquillity in foreign affairs. However, the question of trade with British colonies, especially the West Indies, had been an issue for many years. Jackson's administration secured in 1830 a reciprocity agreement with Great Britain opening this trade. The really remarkable characteristic of Jackson's administration was the relative harmony in the relations of Great Britain and the United States.

The most difficult foreign question was the spoliation claims against France. These claims, resulting from seizures during the Napoleonic Wars, had been presented from time to time without success. Jackson's foreign policy, as outlined in his first annual message to Congress (Dec. 8, 1829), was "to ask nothing that is not clearly right, and to submit to nothing that is wrong." He also affirmed that since the claims remained unsatisfied, they "must, therefore, continue to furnish a subject of unpleasant discussion, and possible collision, between the two governments." His policy of firmness caused France to sign a treaty in 1831 providing for payment of the claims.

The failure of the French government to provide funds for meeting the treaty obligations aroused Jackson's anger. In his message of Dec. 2, 1834, and again in a special message of Jan. 15, 1836, he asked congressional approval of a policy of reprisals in case France delayed longer the fulfillment of her obligations. The French were aroused, diplomatic negotiations were broken off, and preparations for war were made. British mediation of the dispute saved French honor, and the first payments were made in May 1836. Jackson's program of energetic action had been successful:



Charles Phelps Cushing

The Hermitage, Andrew Jackson's home near Nashville.

Last Years.—Jackson left the White House broken in fortune and health but still the idol of the people. He retained his popularity until the end of his life, and continued to wield great national influence. When he arrived at The Hermitage, he had less than \$100. He was forced to sell some of his lands, and to borrow \$10,000 in 1842. The debt was not paid before his death, but he pledged his estate to take care of the obligation. Jackson had always been plagued with precarious health, and the years in the presidency had told on his frail constitution. In retirement he was seldom free from pain. The new content he had given to the term "democracy" lived on as his greatest gift to posterity.

See also UNITED STATES—22. *Financial History* (1775 to 1861); and 41. *Sectional Conflict and Preservation of the Union, 1815–1877* (The Age of Jackson).

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For extended bibliographies on all phases of Jackson's life, consult Oscar Handlin and others, *Harvard Guide to American History* (Cambridge, Mass., 1954).

RICHARD A. McLEMORE,
President, Mississippi College.

JACKSON, Charles Thomas, American chemist and geologist: b. Plymouth, Mass., June 21, 1805; d. Somerville, Aug. 28, 1880. He graduated from Harvard Medical College in 1829 and spent the next three years in Paris, where he studied medicine, geology, and mineralogy. On his return, he practiced medicine in Boston, but gave it up in 1836 to set up a chemical laboratory. During 1837–1844, he was selected to make official geological surveys of Maine, Rhode Island, and New Hampshire, and in 1847 took part in a

survey of mineral wealth in the Lake Superior region for the federal government.

Jackson's inquiring and inventive mind led him to many discoveries which he seems to have put to little use. He made a working model of a telegraph in 1834, several years before Samuel F. B. Morse patented the invention. Jackson claimed to have pointed out the basic principles to Morse, and a heated controversy arose. After the announcement of the discovery of guncotton in 1846, he again claimed priority. About the same time he became involved in a bitter controversy with the dentist William Thomas Green Morton over the introduction of anesthesia in surgery. Jackson had evidently suggested to Morton the use of ether in extracting a tooth, and showed him how to administer it. In November 1846 a patent for the discovery was issued to Morton and Jackson together; but the latter, in letters to the French Académie des Sciences and the American Academy of Arts and Sciences, claimed sole credit for the discovery. The French Académie de Médecine divided the Monthyon Prize of 5,000 francs between Jackson and Morton, but Morton rejected his share, insisting the discovery was his alone. Jackson's later years were embittered by these quarrels, and from 1873 until his death he was afflicted by mental illness.

JACKSON, Chevalier, American laryngologist: b. Pittsburgh, Pa., Nov. 4, 1865; d. Philadelphia, Aug. 16, 1958. He studied at the Western University of Pennsylvania (now University of Pittsburgh) from 1879 to 1883, and took his M.D. at Jefferson Medical College, Philadelphia, in 1886. After further study in Europe, he practiced in Pittsburgh, specializing in diseases of the throat, and in 1912 was named professor of laryngology at the University of Pittsburgh School of Medicine. Jackson pioneered in peroral endoscopy, perfecting the technique of removing foreign bodies from the digestive tract by means of the esophagoscope and from the respiratory tract by means of the bronchoscope. In 1916 he established a bronchoscopic clinic in Philadelphia, where he served on the faculty of Jefferson Medical College and later at the University of Pennsylvania and Temple. Among his books, written in collaboration with his son, Chevalier Lawrence Jackson (1900-1961,) are *Bronchoscopy, Esophagoscopy, and Gastroscopy* (3d ed., 1934), *Cancer of the Larynx* (1939), and *Bronchoesophagology* (1950). Father and son cofounded the bronchoscopic clinic at Temple University in 1930.

JACKSON, Frederick George, English explorer: b. Alcester, Warwickshire, England, March 6, 1860; d. London, March 13, 1938. As a youth he spent three years in the hinterland of Australia and subsequently attended the University of Edinburgh. Inspired with an ambition to reach the North Pole, he made a preparatory sledge journey (1893-1894) across Siberia's frozen tundra from Khabarovo to Kirkenes, Norway, and under the patronage of Alfred C. W. Harmsworth (later Viscount Northcliffe), set out on his polar expedition later in 1894. Jackson failed to reach the North Pole, but made extensive explorations of Franz Josef Land over a period of three years. On June 17, 1896, he encountered Fridtjof Nansen and his companion, who were traveling by sledge, and probably saved their lives by returning them to Vardø, Norway, in one of his ships. For these services Jackson

was awarded the Norwegian Order of St. Olaf in 1898. He subsequently served in the army in the South African War (1899-1902) and World War I, and traveled in tropical Africa. He was also a member of the League of Nations investigating commission which reported the existence of slavery in Liberia (1930). Jackson's publications include *The Great Frozen Land* (1895); *A Thousand Days in the Arctic* (1899); and *The Lure of the Unknown Lands: North Pole and Equator* (1935).

JACKSON, Hall, American surgeon: b. Hampton, N.H., Nov. 11, 1739; d. Portsmouth, Sept. 28, 1797. Son of Dr. Clement Jackson of Portsmouth, N.H., he began to study medicine in his father's office, and then went to London for three years, specializing in the study of smallpox. While there, he learned the operation of cataract couching, which he later was one of the first to perform in America. He was also among the first to introduce the use of digitalis in America, obtaining it from foxglove which he grew from seed brought from England. He began to practice in Portsmouth, but in 1764 was called to Boston to perform inoculations during the smallpox epidemic there. Returning to Portsmouth, he aided in establishing smallpox hospitals on Henzell's Island and on Cat Island in Marblehead harbor. After the Battle of Bunker Hill (June 1775) he was called to Boston again to attend wounded soldiers. In November of that year the New Hampshire Provincial Congress commissioned him chief surgeon of the province's troops with the rank of colonel, and he served in this capacity throughout the Revolutionary War.

JACKSON, Helen Maria Hunt (nee FISKE), American author: b. Amherst, Mass., Oct. 15, 1830; d. San Francisco, Calif., Aug. 12, 1885. Daughter of an Amherst College professor, she married (1852) Edward Bissell Hunt, an officer in the army engineers, who was accidentally killed in 1863 while testing a submarine device which he had invented. Her only surviving child died two years later. Mrs. Hunt began to write for publication in 1865, contributing poems, articles, and stories to the *Nation*, *Independent*, *Hearth and Home*, and other magazines, frequently over the signature H.H. The Saxe Holm stories which ran in *Scribner's Monthly* have been attributed to her, though she never admitted their authorship. Much of her work was published anonymously. In 1872-1874 she visited California and Colorado, and in Colorado Springs met the financier William Sharpless Jackson, whom she married in October 1875.

While living in the West, Helen Hunt Jackson became deeply interested in the Indians and incensed at their neglect by the government. After several months of research at the Astor Library in New York, she wrote and distributed to the members of Congress, at her own expense, a review of the government's dealings with the Indian tribes, calling it *A Century of Dishonor* (1881). The only apparent result was her appointment to a special government commission in 1882 to investigate and report on the condition and needs of the Mission Indians of California. When this, too, failed to get results, she determined to use fiction to arouse public interest in the plight of the Indians and spur government action on their behalf. In 1884 she published *Ramona* (q.v.), which attained great popularity

as a romance of old California and still is widely read; it has also been made into a technicolor motion picture. Her only other noteworthy novel is *Mercy Philbrick's Choice* (1876), supposedly based on the life of Emily Dickinson, her school-mate and lifelong friend. *Glimpses of Three Coasts*, reminiscences of travel in Europe and America, was published posthumously in 1886, and *Between Whiles*, a volume of short stories, in 1887.

JACKSON, Sir Henry Bradwardine, British admiral and wireless expert: b. Barnsley, Yorkshire, England, Jan. 21, 1855; d. Hayling Island, Hampshire, Dec. 14, 1929. He joined the Royal Navy at the age of 13, became a torpedo officer, and in 1890 began to experiment with wireless communications for the fleet. As a result of his efforts, the Royal Navy was equipped with wireless installations in 1900, and in recognition of these services the Royal Society elected him a member in 1901. Knighted in 1906, he became the first head of the new Royal Naval War College at Portsmouth (1911) and chief of the War Staff of the Admiralty (1913). He was first sea lord (1915-1916) at the time of the Battle of Jutland, and president of the Royal Naval College at Greenwich from 1916 to 1919, when he was promoted admiral of the fleet. As first chairman of the Radio Research Board in Great Britain (from 1920), he directed important experiments in the study of radio waves. He won the Hughes Medal of the Royal Society in 1926.

JACKSON, Henry Rootes, American lawyer, diplomat, and Confederate general: b. Athens, Ga., June 24, 1820; d. Savannah, May 23, 1898. After graduating from Yale in 1839, he studied law in Georgia, began to practice in Savannah, and in 1843 was appointed a United States district attorney. He served through the war with Mexico as colonel of a Georgia regiment, and in 1849 was appointed a judge of the Superior Court, resigning in 1853 to become chargé d'affairs in Austria. Promoted minister resident, he served until 1858, and on his return from Europe was offered the chancellorship of the University of Georgia, but declined. When the Confederacy was formed, he accepted an appointment as judge in the Georgia courts, but on the outbreak of war resigned to serve in the Confederate Army. After the fall of Atlanta, while serving as brigadier general in Tennessee, he was captured and held prisoner until the close of the war, when he returned to his law practice. In 1885 he was appointed minister to Mexico, but resigned the following year because of his disapproval of the government's handling of the case of the American schooner *Rebecca*, seized by Mexico on a charge of smuggling. For many years he was president of the Georgia Historical Society and a trustee of the Peabody Education Fund (q.v.). He published a volume of verse, *Tallulah and Other Poems* (1850), and is remembered as the author of the poem *Red Old Hills of Georgia*.

JACKSON, Holbrook, English author and editor: b. Liverpool, England, Dec. 31, 1874; d. Bournemouth, June 16, 1948. After publishing an early work (1899) on Edward Fitzgerald's translation of Omar Khayyâm, he made his reputation as a critic and literary historian with

Bernard Shaw (1907), the first full-length study ever done on Shaw. It was followed by *William Morris* (1908; rev. ed., 1926) and *The Eighteen Nineties* (1913), a valuable critical history of that unique decade in English literature. In 1913, with Ralph Hodgson and the artist Claud Lovat Fraser, Jackson brought out *Flying Fame*, a series of chapbooks and broadsides notable for their typography and Fraser's illustrations, and containing original works by Walter de la Mare, James Stephens, and others. From 1917 to 1923 he published and edited the literary periodical *To-day*, in which some of the earlier work of Ezra Pound and T. S. Eliot first appeared. An expert on typography and problems of the publishing industry, Jackson was editorial director of the National Trade Press from 1917. His *Anatomy of Bibliomania*, 2 vols. (1930-31) is important as a source book for literary anecdotes.

JACKSON, Howell Edmunds, American jurist: b. Paris, Tenn., April 8, 1832; d. near Nashville, Aug. 8, 1895. He graduated from law school at Lebanon, Tenn., in 1856, and practiced in Memphis from 1858. Jackson originally opposed secession, but throughout the Civil War served the Confederacy as receiver of sequestered property. Elected to the state legislature in 1880 as a Democrat, he was chosen United States senator in 1881 by the votes of both Democratic and Republican members and served in the Senate until 1886, resigning to accept appointment as United States Circuit Court judge for the 6th circuit. He became the first presiding judge of the Circuit Court of Appeals established at Cincinnati, Ohio, in 1891, and in 1893 was appointed an associate justice of the United States Supreme Court. Shortly before his death he dissented from the majority decision holding the income tax unconstitutional.

JACKSON, James, American physician: b. Newburyport, Mass., Oct. 3, 1777; d. Boston, Aug. 27, 1867. The brother of Patrick Tracy Jackson (q.v.), he was educated at Harvard College and Medical School, and spent the year 1799-1800 in London, where he learned the newly discovered technique of vaccination, which he was among the first to put into practice upon his return to America. Jackson took an active part in the reorganization and rebuilding of Harvard Medical School, and in 1812 was appointed Hersey professor of the theory and practice of medicine there, serving for more than 20 years. He was also the leading figure in the organization of the Massachusetts General Hospital, opened in 1821. In a paper published (1822) in the *New England Journal of Medicine*, he gave the first description of peripheral alcoholic neuritis. His *Letters to a Young Physician* (1855) became a medical classic.

JACKSON, James, American soldier and statesman: b. Moreton Hampstead, Devonshire, England, Sept. 21, 1757; d. Washington, D.C., March 19, 1806. Emigrating to Georgia at the age of 15, he made his home in Savannah, and throughout the Revolutionary War served with the Georgia troops, attaining the rank of lieutenant colonel. When the British evacuated Savannah in July 1782, he commanded the American garrison installed in the city and was presented with a house and lot by the state legislature. After the war he studied law, built up an

extensive practice, and was several times a member of the Georgia legislature. Declining the governorship in 1788, he was elected to Congress in 1789 and to the United States Senate in 1793. He resigned, however, in 1795, returning to Georgia to fight the Yazoo Fraud (q.v.), which he succeeded in having repealed at the next session of the state legislature. He was a member of the convention that framed a new constitution for Georgia in 1798, and was elected governor the same year, serving until 1801, when he was again returned to the United States Senate, where he served until his death.

JACKSON, John Adams, American sculptor: b. Bath, Me., Nov. 5, 1825; d. Pracchia, Italy, Aug. 30, 1879. He received his early art training in Boston, and later studied in Paris. In 1851 he modeled a bust of Daniel Webster from portraits provided by the Webster family. While in Florence, Italy, in 1853, he did a bust of the poet Thomas Buchanan Read, which was purchased by the Union League Club of Philadelphia; and in Paris, in 1854, he made a portrait bust of the American minister to France, John Young Mason. Lyman Beecher and Wendell Phillips, among many other men of distinction, sat for him in the United States. He opened a studio in New York City in 1858, but two years later returned to Italy and settled in Florence. On a visit to New York in 1867 he designed a statuary group for the south gatehouse of the reservoir in Central Park, and in 1874 executed a soldier's monument in Lynn, Mass.

JACKSON, John Hughlings, English neurologist: b. Green Hammerton, Yorkshire, England, April 4, 1835; d. London, Oct. 7, 1911. He received his M.D. from St. Andrews University in 1860, and two years later in London joined the staff of the National Hospital for the Paralysed and Epileptic, where he remained active until 1906, specializing in nervous diseases. His earliest research, published about 1864, dealt with the cerebral location of speech defects (aphasia). He later (1870) discovered the source of local epileptic convulsions, named Jacksonian epilepsy in recognition of his work. He also identified uncinete epilepsy, so called after his discovery of its origin in the uncinete gyrus of the brain. In his Croonian lectures (1884) at the College of Physicians in London, he propounded the theory of three levels in the evolution and constitution of the nervous system, explaining nervous diseases as a process of dissolution of the higher levels, leaving the action of the lower levels uncontrolled.

JACKSON, Patrick Tracy, American industrialist: b. Newburyport, Mass., Aug. 14, 1780; d. Beverly, Sept. 12, 1847. He was the son of Jonathan Jackson, a broker and member of the Continental Congress, and the brother of James Jackson (1777-1867, q.v.). Patrick attended Dummer Academy, and at 15 was apprenticed to a Newburyport merchant. After several voyages to the West Indies and the Far East in charge of cargo, he had accumulated enough capital by 1808 to go into the shipping business for himself in Boston. He prospered, and when the War of 1812 disrupted his business, he began the manufacture of cotton textiles, organizing with Nathan Appleton (q.v.) and others the

Boston Manufacturing Company. Their mill at Waltham, equipped with power looms designed and constructed by Jackson's brother-in-law Francis Cabot Lowell (q.v.) and Paul Moody, is believed to have been the first mill in the world that handled the entire manufacturing process from raw cotton to finished cloth. In 1820, Jackson and his associates bought land on the Merrimack River and organized the Merrimack Manufacturing Company, founding the town of Lowell, Mass. Its business soon outgrew the transportation facilities provided by highway and canal, and in 1830 Jackson obtained a charter for a railroad between Lowell and Boston and directed its construction until completion.

JACKSON, Robert Houghwout, American jurist: b. Spring Creek, Pa., Feb. 13, 1892; d. Washington, D.C., Oct. 9, 1954. After completing the course at Albany Law School, he was admitted to the bar in 1913 and began to practice in Jamestown, N.Y. Within a few years he became corporation counsel of Jamestown and general counsel for several local public service corporations. Jackson came to the attention of Franklin D. Roosevelt while the latter was governor of New York and Jackson was serving on a commission to study the New York State judicial system. After Roosevelt became president, Jackson was named general counsel of the Bureau of Internal Revenue (1934), prosecuting the \$750,000 tax case against Andrew W. Mellon, former secretary of the treasury, who was later absolved of any intent to defraud. In 1935, Jackson became special counsel for the Securities and Exchange Commission, and in 1936 assistant attorney general in charge of the antitrust division. As solicitor general of the United States, from 1938, he argued before the Supreme Court an important series of cases involving the constitutionality of New Deal legislation, winning 38 of the 44 cases he presented for the government.

Jackson entered Roosevelt's cabinet as attorney general in January 1940, and 18 months later was sworn in as an associate justice of the Supreme Court, where he was noted for his independent, often sharply worded opinions. In May 1945 he was named by President Harry S. Truman to the War Crimes Commission and served as chief United States prosecutor when the International Military Tribunal was established. In this capacity he conducted the cases against such leading Nazis as Herman Goering, Joachim von Ribbentrop, Franz von Papen, and Julius Streicher. With the completion of the trials late in 1946, he returned to the Supreme Court. During his later years on the bench he was more middle-of-the-road in his thinking, but still vigorous and outspoken. In a partial dissent to the majority ruling on the Taft-Hartley non-Communist oath (May 1950), he said, "It is time enough for the law to lay hold of the citizen when he acts illegally, or in some rare circumstances when his thoughts are given illegal utterance. I think we must let his mind alone." His final judicial act was his appearance on the bench while ill, to verify the unanimity of the Supreme Court's 1954 decision against racial segregation in the public schools.

Among Jackson's publications are *The Struggle for Judicial Supremacy* (1941), *The Case Against the Nazi War Criminals* (1946), and *The Nürnberg Case* (1947).

JACKSON, Sheldon, American missionary and educator: b. Minaville, N.Y., May 18, 1834; d. Asheville, N.C., May 2, 1909. Graduated from Princeton Theological Seminary in 1858, he entered the Presbyterian ministry and became a missionary in the West, working with Indians and whites. In 1870 he was named superintendent of missions for the Rocky Mountain area and in 1884 for Alaska, where he became the first federal superintendent of public instruction in 1885. He served in this capacity for the rest of his life, setting up schools for whites, Indians, and Eskimos, and surveying the country's resources to help the inhabitants. Jackson induced the government to import into Alaska a reindeer herd from Siberia for the purpose of renewing the Eskimos' dwindling food supply, and thus laid the foundation for Alaska's present reindeer industry. His reports on the church and education in Alaska are valuable contributions to the history of the area.

JACKSON, Stonewall. See **JACKSON, THOMAS JONATHAN.**

JACKSON, Sir Thomas Graham, English architect: b. Hampstead, England, Dec. 21, 1835; d. London, Nov. 7, 1924. He graduated from Oxford in 1858, and for the next three years studied architecture with Sir George Gilbert Scott. Jackson designed many buildings for Oxford, including the New Examination Schools, whose foundations were laid in 1876; buildings at Brasenose College (1886-1889, 1909-1911) and Hertford College (1887-1890, 1903-1913), including the chapel (1908); and the restoration of Wadham College (1900-1908). In addition, Jackson designed many churches and schools throughout England, including buildings at Eton, Rugby, and Harrow. In 1913 he was made a baronet.

Jackson was skillful in the use of colored ornament and in the adaptation and combination of unusual processes and materials, such as sgraffito plaster work, terra cotta, marble, and mosaic. His study of architecture along the eastern Adriatic coast (now Yugoslavia) led in 1892 to his restoration of the campanile of the cathedral at Zara (Zadar). During his last years he wrote a series of comprehensive histories of Byzantine and Romanesque, Gothic, and Roman architecture.

JACKSON, Thomas Jonathan (called **STONEWALL JACKSON**), American Confederate general: b. Clarksburg, Va. (now in West Virginia), Jan. 21, 1824; d. Guiney's Station, Va., May 10, 1863. Orphaned when he was six, Thomas spent most of his boyhood at the home of his uncle, Cummins E. Jackson, in Lewis County. His schooling was sketchy, coming largely from itinerant teachers, and he was scholastically unprepared to win an appointment to the United States Military Academy at West Point, which he sought in 1842. The resignation of the successful candidate gave Jackson a second chance, and he received a cadetship. He had worked desperately for the appointment, since it represented his sole means of obtaining a higher education. Barely passing the entrance examinations, Jackson found himself in late June 1842 suffering the rigors of camp life with such classmates as Ambrose Powell Hill, George B. McClellan, Dabney H. Maury, and George E. Pickett. Though woefully deficient in training, Jackson grimly fought his way to 17th place in the class standing by the

time he was graduated in June 1846. He selected the artillery as his branch of service.

Early Career.—With K Company, 1st United States Artillery, Jackson went to Mexico as a brevet 2d lieutenant to fight under Gen. Zachary Taylor. Transferred to Gen. Winfield Scott's army, he participated in the siege of Vera Cruz (March 1847), saw action at Cerro Gordo in April, and was brevetted for gallantry in action at Contreras, Churubusco and Chapultepec. His outstanding conduct earned him the permanent rank of 1st lieutenant and the brevet rank of major by the end of the fighting in Mexico. Assigned to duty with occupation forces in Mexico City, Jackson spent several happy months there and became something of a social lion. He studied Spanish, flirted with romance, and urged by Capt. Francis Taylor, his commanding officer, he undertook a personal study of religion, beginning with Roman Catholicism. Soon he had evolved a private code of morals which served until his affiliation with the Presbyterian Church on Nov. 22, 1851.

In July 1848, Jackson returned to the United States and served at various New York and Pennsylvania forts until October 1850, when he and his company were sent to the Seminole Indian theater in Florida. At Fort Meade, Fla., he had an unhappy altercation with the post commander, Maj. William Henry French, and the episode ended with Jackson's departure from the service on May 21, 1851, with nine months' terminal leave. He accepted a professorship of natural and experimental philosophy and artillery tactics at the Virginia Military Institute (VMI) at Lexington, Va. His former Mexican war comrade and future brother-in-law, Maj. Daniel Harvey Hill, had nominated him for the position. Jackson taught at VMI from August 1851 until April 1861. Never a popular teacher, he became the butt of many cadet pranks, the object of much derisive doggerel verse, and the target of the Society of the Alumni. A few cadets saw beneath his cloak of shyness, and those came to appreciate him as a "grand, gloomy and peculiarly good man."

The Lexington decade brought great changes in Jackson's personal life. Here he found the religion he had long sought and devoted himself to it with characteristic wholeheartedness. Here, too, he found a real and happy home for the first time. On Aug. 4, 1853, he was married to Elinor Junkin, daughter of the Reverend George Junkin, president of Washington College in Lexington. Under her gentle influence he began to doff his relentless punctilio, to curb his terrible shyness, and to be himself—at least among his family and close friends. A tragic end to this period of home life came on Oct. 22, 1854, when Mrs. Jackson died in childbirth. After months of despondency, Jackson remarried. His new bride, Mary Anna Morrison of North Carolina, was also the daughter of a Presbyterian minister, and a sister of Mrs. Daniel Harvey Hill. After their marriage on July 16, 1857, the Jacksons bought a house and finally moved in during the winter of 1858. Again Jackson entered into the spirit of contented domestic life.

Civil War to Romney Expedition.—The first interruption of this new-found happiness came with the John Brown crisis in October 1859. Jackson took part of the VMI cadet corps to witness Brown's hanging in December, and afterward bent his efforts toward preparing for what-

ever emergency the Union might face. A Democrat and small slaveholder, Jackson voted for John C. Breckinridge in 1860 and remained a Union man until Virginia seceded on April 17, 1861. On April 21, Jackson led the VMI cadets to Richmond, and on the 27th, although unknown in Virginia political circles, he received a commission as colonel in the Virginia state forces, with orders to organize the defense of the strategic town of Harpers Ferry. Jackson, taking charge of a disorganized group of militiamen, soon had a well-trained brigade under his command, and posted guns to command the heights overlooking the town, the confluence of the Potomac and Shenandoah rivers, and the important Baltimore and Ohio railroad bridge. On May 24 he turned the post over to Gen. Joseph E. Johnston and assumed command of a brigade in Johnston's Army of the Shenandoah. With this brigade he engaged Gen. Robert Patterson's Union forces at Falling Waters, Va., on July 2, 1861, and in his first battle command of the war gained a tactical success. Shortly after this engagement he was commissioned a brigadier general in the Confederate Army, effective June 17, 1861.

Jackson's brigade, with the rest of Johnston's army, went to aid Gen. Pierre G. T. Beauregard at Manassas Junction on July 18, and on July 21 took a decisive part in the Battle of First Manassas (Bull Run). Posting his brigade on the strategic Henry House Hill toward the Confederate left, Jackson steadied the Southern front against the flank attack by Gen. Irvin McDowell's Union troops. Jackson's men, standing firm on the hill, caught the attention of Gen. Bernard E. Bee as he tried to rally his shaken troops; he pointed to Jackson's line and shouted an immortal battlecry: "There is Jackson standing like a stone wall. Let us determine to die here, and we will conquer." The sobriquet "Stonewall" stuck with Jackson from that day of victory at Manassas.

Praise for Jackson came from all parts of the Confederacy, and on Oct. 7, 1861, he was commissioned a major general. In November he went to the Shenandoah Valley to command the newly created Valley District, which embraced all the territory between the Blue Ridge and Allegheny mountains, from Staunton to Harpers Ferry. Finding only some 1,600 men available in the valley, Jackson called out the militia of the district and obtained the assignment of his own original "Stonewall Brigade." With additional reinforcements bringing his total strength to about 8,500 men, he began a winter campaign in January 1862 to reoccupy Romney, Va., then held by Union forces. After a march tragically like Napoleon's retreat from Moscow, Jackson occupied the town on January 14, left a garrison, detached troops to neighboring settlements, and took his own brigade back to district headquarters at Winchester, Va. The Romney expedition earned Jackson the hatred of some subordinates, and complaints to Richmond prompted Confederate Secretary of War Judah P. Benjamin to order the reconcentration of Jackson's entire command at Winchester. Faced with civilian interference in his military assignments, Jackson submitted his resignation, but the wise counsel of General Johnston, the urgings of clerical friends, and the protest of Virginia's governor, John Letcher, changed Jackson's mind.

Shenandoah Valley Campaign.—Ordered to protect Johnston's left flank against a thrust by the Union general, Nathaniel P. Banks, Jack-

son reorganized his army. When he heard that Banks had detached men to the eastern theater, Jackson determined to attack him in the hope of recalling the detached troops. With a reduced force he struck Banks' rear guard under Gen. James Shields at Kernstown on March 23, 1862, sustained a tactical defeat, but gained a strategic victory which brought Banks' men back to the valley. Gen. Robert E. Lee, who had direction of military operations outside of the Richmond sector, advised further pressure against Banks, and Jackson, reinforced by the division of Maj. Gen. Richard S. Ewell in late April, began his world-famous Shenandoah Valley campaign. Deceptively moving toward Richmond, he marched his own division rapidly out of the valley, reversed direction, and went to the support of Gen. Edward Johnson west of Staunton. With 10,000 men Jackson attacked Gen. Robert H. Milroy's forces near the village of McDowell, Va., on May 8, defeating and driving them toward Gen. John C. Frémont's Union army near Franklin, Va. With his left flank secure, Jackson returned to the Shenandoah Valley and, joined by Ewell's division, struck at Banks. With about 16,000 men and 48 guns, he obliterated Banks' outpost at Front Royal on May 23, thus forcing him to retreat from Strasburg toward Winchester. Washington was convinced that a major threat to the North had developed in the valley. Hearing of Banks' headlong flight, President Abraham Lincoln withdrew troops from General McDowell's army near Fredericksburg and consequently stalled General McClellan's operations against Richmond. Jackson had gained his primary objective; he had protected the Confederate capital for a time.

Jackson defeated Banks at Winchester on May 25, 1862, and drove him toward Williamsport on the Potomac. Advised that Lincoln planned to trap him, Jackson retreated swiftly—so swiftly that his men earned the name "foot cavalry"—and eluded two Federal armies. At Cross Keys and Port Republic, in the southern end of the valley, Jackson turned on the armies of Frémont and Shields, defeating them in succession on June 8 and 9. The lightning valley campaign had paralyzed no less than 60,000 Federal soldiers (at least 40,000 of whom should have been aiding McClellan at Richmond) and frightened Washington. It buoyed up sagging Southern spirits and gave the Confederacy a new hero.

With Federal thrusts blunted in the valley and with many bluecoats out of position beyond the Blue Ridge, General Lee called Jackson to Richmond to assist in defeating McClellan. Lee planned a wheeling turn around McClellan's right flank north of the Chickahominy River—a turning movement which would force the Federals out of their works and drive them into the James River. The attack was to begin on June 26, 1862, but Jackson proved unaccountably late. Lee's battle began badly, with a bloody attack on Union positions which Jackson should have flanked. All during the 26th, Jackson took no part in the action; but on the 27th, reinforced by D. H. Hill's division, he reached McClellan's flank and rear and sought to squeeze the enemy's right between his troops and Lee's units at Gaines' Mill. After costly fighting the Federals escaped across the Chickahominy. Lee's army rested a day while he sought information on enemy intentions. On June 29, Jackson was delayed most of the day at the Grapevine Bridge

by orders from army headquarters, and on the 30th he fell into a strange lethargy. He made no serious effort to cross White Oak Swamp Bridge, despite a heavy battle raging at nearby Frayser's Farm. For this failure he has been severely criticized by military analysts, and many reasons for it have been offered. Some ascribe it to unfamiliarity with the ground, to poor staff work, and to lack of experience in commanding a large force. Perhaps a better reason is physical exhaustion; Jackson had been in the saddle for several days prior to the White Oak action, and he was worn down by exertion, by the unaccustomed heat, and the dank swampland. All these factors combined to put him in a state of somnambulism. He regained his aggressiveness on July 1, fighting hard at Malvern Hill.

Second Manassas (Bull Run).—With McClellan driven to the protection of his gunboats, Jackson proposed an invasion of the North. Although Confederate resources did not permit a sustained offensive, Lee apparently concluded that Jackson did better in independent commands which permitted wide discretion, and began a model partnership with him, detaching Jackson to deal with a new Federal invasion army under Gen. John Pope. Jackson met Pope's advance under Banks at Cedar Mountain on Aug. 9, 1862, sustained an initial reverse, and then routed the enemy. Lee then determined to send part of the Army of Northern Virginia behind Pope and cut him off from Washington. Jackson drew the flanking assignment, took his wing of the army around Pope's right, and hit the Federal supply depot at Manassas Junction. After purloining and destroying an incredible amount of supplies, Jackson entrenched a strong position near the old Manassas battlefield and beat off a heavy attack by Pope on August 29. When Pope renewed the advance on the 30th, he went against both Jackson's and James Longstreet's wings, but did not know it until he had been beaten in the Battle of Second Manassas (Bull Run). One of Jackson's men ventured that the battle had been won by hard fighting, but Jackson, in a typical reply, answered: "No, no, we have won it by the blessing of Almighty God." Defeats might be the result of human error, but victories were gifts from Providence.

Harpers Ferry and Sharpsburg (Antietam).—Lee now decided to carry the war to the North, and in order to clear his line of communications with Richmond through the Shenandoah Valley, he again trusted to Jackson a vital independent assignment: Jackson's wing would eliminate the 11,000-man Federal garrison at Harpers Ferry and rejoin the main army near Hagerstown, Md., in mid-September. With cold efficiency Jackson plotted the reduction of the enemy garrison by artillery, and on September 15, Harpers Ferry was surrendered. The action had been one to please a professor of artillery tactics. Informed of the rapid advance of a rejuvenated Federal army, again under McClellan, Jackson left A. P. Hill's division to arrange the surrender and marched rapidly with the remainder of the wing to Sharpsburg, Md., where Lee had retired to reconcentrate. On September 17, Jackson's men resolutely stood like a stone wall on the left of Lee's line at the Battle of Sharpsburg (Antietam), and the timely arrival of A. P. Hill saved the day for the Confederates. Lee retired across the Potomac during the night of September 18-19. Jackson's quick decision to attack a

probing Union force at Shepherdstown, early in the morning of the 19th, probably saved the army; it certainly saved the reserve artillery.

After the Maryland campaign Lee reorganized the army into two corps. On Oct. 10, 1862, Jackson was commissioned a lieutenant general and assigned command of the Second Corps; Longstreet would command the first. Lee took Longstreet's men east to watch Federal moves, leaving Jackson in the Shenandoah. On November 22 (the day before his daughter Julia Laura was born), Jackson moved his corps toward Fredericksburg, where he took position on the right of Lee's line. Here he held against determined Federal assaults during the Battle of Fredericksburg (Dec. 13, 1862).

The army went into winter quarters near Fredericksburg to await the spring campaign. These quiet months Jackson devoted to improving himself as an army administrator, and in keeping with his motto, "You may be whatever you resolve to be," he succeeded.

Chancellorsville.—Federal Gen. Joseph Hooker began the spring campaign on April 29, 1863, by marching up the Rappahannock in an attempt to turn Lee's left. Jackson, sent to meet Hooker, hit the enemy advance in the Wilderness near Chancellorsville on May 1, 1863. By nightfall Jackson and Lee, working in close harmony, decided that Hooker must be flanked, and Lee gave Jackson his greatest orders: if a feasible route could be found, he would command the flank march. By dawn of May 2, scouts reported a road which would lead Jackson behind the bluecoats. He prepared to march with some 28,000 men, leaving Lee about 15,000 to face Hooker's entrenched force of over 100,000. At 5:15 p.m. on May 2, after a 15-mile march—one of the greatest marches of history—Jackson attacked Hooker's right flank element, the 11th United States Army Corps, and literally blew it out of the war. He intended to get between Hooker and the fords of the Rappahannock and to squeeze the enemy between his own and Lee's men. After the first impetus of the attack waned, Jackson halted his men to regroup and trotted ahead of his line to reconnoiter.

When he rode back on his sorrel toward his own men, he and his staff were mistaken for Federals and fired on; Jackson's left arm was shattered, and he was hit in the right hand. His arm was amputated, his other wounds were dressed, and he was moved to Guiney's Station, a safe distance from the front. Although indications were that he would recover, pneumonia set in on May 7; he grew rapidly worse, sinking into a limbo of lucidity and delirium. Several times Jackson roused to see his wife. He clung firm to his faith, and occasionally he thought of the army. In the afternoon of May 10, 1863, a Sunday—he had always wanted to die on Sunday—he rallied to speak his stirring last words: "Let us cross over the river, and rest under the shade of the trees."

The Confederacy grieved for its fallen captain; even the Federals mourned the loss of a great American. Richmond held one of the last state funerals, and Stonewall was laid to rest in Lexington. Many speculated then, and have since, that with his death the South lost its chance to win the war. Certain it is that the impetus of victory died with him.

See also CIVIL WAR IN AMERICA; and separate articles on individual battles mentioned.

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JACKSON, William, American soldier, secretary of the Constitutional Convention: b. Cumberland, England, March 9, 1759; d. Philadelphia, Pa., Dec. 18, 1828. Brought up by a guardian in South Carolina, he joined the colonial forces at the outbreak of the American Revolution, participated in the 1778 expedition against St. Augustine, Fla., and served as aide to Maj. Gen. Benjamin Lincoln in the Southern Department, with the rank of major. As secretary to John Laurens on his mission to France in 1781, Jackson supervised the shipment of supplies to the Continental Army. Returning to the United States in February 1782, he was assistant secretary of war for two years under Lincoln. When the Constitutional Convention was called in Philadelphia in 1787, he petitioned George Washington for the post of secretary, and on Hamilton's nomination received the appointment. By order of the convention its records were burned, except the journal of proceedings and the yeas and nays; these, in Jackson's hand, are the only surviving official convention records. Jackson was admitted to the Pennsylvania bar in 1788, and the following year President Washington appointed him one of his personal secretaries. He resigned at the end of 1791 to enter private business, and from 1797 to 1801 was surveyor of customs in Philadelphia.

JACKSON, William Henry, American photographer and painter: b. Keeseville, N.Y., April 4, 1843; d. New York, N.Y., June 30, 1942. He served for a year in the Union Army during the Civil War, and after traveling west to California, settled in Omaha, Nebr., as a photographer. In 1870 he joined the United States Geological Survey as official photographer for the expedition headed by Ferdinand V. Hayden; his photographs of the Yellowstone region, along with the expedition's report, were influential in the erection of Yellowstone National Park by act of Congress in 1872. Jackson remained with the Survey for eight years, photographing the scenic wonders of the West, and later also took notable pictures of boom towns such as Leadville and Cripple Creek, Colo. From 1879 to 1897 his headquarters were in Denver and subsequently in Detroit, Mich. In 1924 he settled in Washington, D.C., and took up painting, and at the age of 92 began a series of murals on the Old West for the Department of the Interior Building. His 40,000 negatives were bought by Henry Ford for the Edison Museum in Dearborn, Mich.

Consult his autobiography, *Time Exposure* (1940); and Jackson, Clarence S., ed., *Picture Maker of the Old West* (1947).

JACKSON, town, Alabama, in Clarke County, on the Tombigbee River, 60 miles north of Mobile. In a lumbering and farming area, the town manufactures hosiery, but the atmosphere of the Old South lingers on in the Greek Revival man-

sions and the oak-lined streets. Jackson is served by the Southern Railway System. Artesian mineral wells and Salt Springs State Park are nearby, while south of the town are the swamps of the Tombigbee River. Originally a trading post, Jackson was incorporated as a town in 1816. Pop. 4,959.

JACKSON, town, Louisiana, on Thompson Creek, 27 miles north of Baton Rouge, at an altitude of 100 feet. Served by the South Shore Line railroad, it is the largest town in East Feliciana Parish. Originally called Bear Corners, and later Buncombe, it was renamed Jackson after the victory of Andrew Jackson at the Battle of New Orleans (1815). The East Louisiana State Hospital for mental diseases is situated in Jackson. The town is governed by a mayor and council. Pop. 1,824.

JACKSON, city, Michigan, situated at an altitude of 940 feet on the Grand River about 70 miles west of Detroit. It is the seat of Jackson County, and an industrial, commercial, and rail center for the surrounding agricultural area. Among its manufactures are metal products, auto and airplane parts, machine tools, heating apparatus, furniture, clothing, and food products. The city is served by American Airlines and by the New York Central and Grand Trunk Western railroads, and has extensive railroad shops. Jackson Junior College is located here, and Michigan State Prison nearby.

Named after Andrew Jackson, the place was settled in 1829, incorporated as a village in 1843, and as a city in 1857. A state gathering held here on July 6, 1854, was one of the first to adopt the name "Republican Party" for the coalition of antislavery forces forming in the North after the Kansas-Nebraska Act of that year. Jackson has been governed by a council and city manager since 1915. Pop. 50,720.

JACKSON, city, Minnesota, seat of Jackson County, on the Des Moines River, 27 miles west of Fairmont. Its altitude is 1,485 feet. The city is a trade and shipping center for a farm area, freight service being supplied by the Chicago, Milwaukee, St. Paul and Pacific Railroad. The region yields grain, livestock, poultry, and dairy products, and wood products are made here. Settled before 1857, it was part of a large area destroyed in 1862 by the Sioux Indians led by Little Crow. A marker commemorates the victims massacred in Jackson. The settlement was replatted in 1866 and incorporated in 1881. Pop. 3,370.

JACKSON, city, Mississippi, state capital and seat of Hinds County, located on the west bank of the Pearl River, 195 miles south of Memphis, Tenn., at an altitude of 295 feet. It has the commission form of government.

Jackson is one of the chief commercial and industrial centers of Mississippi, with trade in cotton and other agricultural products. The city's manufactures include lumber, wood products, furniture, cottonseed oil, clay products, fluorescent lamps, vehicle body parts, steel and iron castings, machinery, bricks and tiles, hydraulics, kitchenware, clothing, and packed meat. Natural gas fields just south of Jackson have greatly stimulated industrial growth since they were opened in the 1930's. The city is served by the

Gulf, Mobile, and Ohio Railroad (freight only) and the Illinois Central. Its municipal airport, greatly enlarged in 1949 by the acquisition of the United States Air Force field (Hawkins Field), is served by Southern Airways and Delta, Chicago, and Southern Air Lines.

Jackson's educational facilities include Belhaven College, Millsaps College, the University of Mississippi School of Medicine, and Jackson College for Teachers. Nearby are Mississippi College, in Clinton, and Tougaloo Southern Christian College. All are coeducational. The city has many libraries and a state historical museum, and it maintains its own symphony orchestra and a municipal art gallery. Livingston Park houses the city zoo, while in Battlefield Park Confederate trenches and cannon are still to be seen. The state fairgrounds are also located in Jackson.

History.—Late in the 18th century the French Canadian Louis Le Fleur established a trading post on the Pearl River for trade with the Choctaw Indians. In 1821 the state legislature chose the site, called Le Fleur's Bluff, to be the state capital, and the area was platted and laid out as a seat of government, with alternating squares for buildings and parks. The original statehouse, completed in 1821, first housed a session of the legislature on Jan. 23, 1822. The settlement was renamed after Andrew Jackson, soon to become president, and in 1833 it was incorporated as a town. Although up to 1832 there had been agitation to rescind Jackson's designation as capital, this movement was defeated. Mississippi's second statehouse, now called the Old Capitol, was built in Classic Revival style, with a silver dome. First occupied in 1839, it was completed three years later, as was also the governor's mansion.

During the Civil War, Jackson was twice taken by Union forces, in May and again in July 1863 (see JACKSON, BATTLE AND SIEGE OF). In July, under Gen. William T. Sherman, it was virtually destroyed by fire, except for a few private homes and the Capitol and governor's mansion; these two state buildings and some antebellum homes still survive. Jackson temporarily lost its place as state capital (1863-1865); but after the war, although retarded by the carpetbag rule of the reconstruction era, the city was rebuilt and continued to grow. A new Capitol building, authorized in 1900, was opened in 1903. Although state government has always been a major activity, industry has grown tremendously during the 20th century, with resulting population increases. From a population of 7,816 in 1900 the city grew to 22,817 in 1920, and in the next four decades grew more than sixfold in size. Pop. 144,422.

JACKSON, city, Missouri, seat of Cape Girardeau County, near the Mississippi River, 10 miles northwest of the city of Cape Girardeau, at an altitude of 430 feet. It is a trade and processing center for an area producing timber, grain, and other farm commodities, freight service being supplied by the Missouri Pacific Railroad. Shoes, bricks, lumber, and dairy products are manufactured here. Selected as the site for the county seat in 1814, the new settlement was named for Andrew Jackson and incorporated as a town in 1819. Pop. 4,875.

JACKSON, city, Ohio, county seat of Jackson County, 28 miles northeast of Portsmouth, at

an altitude of 670 feet. The city has steel mills and foundries, and manufactures cigars, clay products, and lumber; natural resources of the locality include coal, gas, clay, gravel, and silica. The Baltimore and Ohio, Chesapeake and Ohio, and Detroit, Toledo, and Ironton railroads furnish transportation.

Jackson was founded in 1817 and soon became a center for Welsh settlers, who at first engaged in farming but in the 1840's began to turn to the coal mines and iron furnaces of the region. The city is noted for its annual eisteddfod (q.v.), in which choral groups from Ohio and neighboring states participate. The city government is by mayor and council. Pop. 6,980.

JACKSON, city, Tennessee, seat of Madison County, located on South Fork of Forked Deer River, about 75 miles northeast of Memphis, at an altitude of 395 feet. Served by the Gulf, Mobile, and Ohio, the Illinois Central, and the Nashville, Chattanooga, and St. Louis railroads, it is a center for industry, railroad repair, and the shipment of such agricultural products as corn, strawberries, and tomatoes. Among its industries are furniture, cotton and cottonseed products, electrical equipment, paper boxes, beverages, and lumber and steel products. Jackson is the home of Lane College, Union University, and Lambuth College, all coeducational. The railroad engineer John Luther Jones, the Casey Jones (q.v.) of ballad fame, is buried here; a monument was erected to his memory in 1947. Several prehistoric mounds have been found in the vicinity.

First settled by North Carolinians in 1819, the community was named for Andrew Jackson. It was incorporated as a town in 1823 and soon after became county seat; it was chartered as a city in 1845. With the coming of the railroad in 1858 it grew rapidly as a trade center for farm products, lumber, and furs. In 1862 the city was headquarters for Confederate Gen. Pierre G. T. Beauregard, but was captured by Union forces in the same year and for a time was the headquarters of Gen. Ulysses S. Grant. It has the commission form of municipal government. Pop. 34,376.

JACKSON, Battle and Siege of, engagements (May and July 1863) in the Vicksburg campaign of the American Civil War. Having failed to take the Mississippi River stronghold of Vicksburg, Miss., from the north, Gen. Ulysses S. Grant determined to attack from another direction. Marching to the south, forces under Grant took Fort Gibson, Miss., and seized the base at Grand Gulf. Then, turning northeast, they won at Raymond on May 12. In order to cut off the Confederate supply line to Vicksburg, Grant determined to take Jackson, major connecting point for Confederate railroad lines. Confederate Gen. Joseph E. Johnston, in Jackson with 6,000 troops, retreated, ordering a small-scale delaying action, and Grant took the city easily on May 14. He evacuated almost immediately to press on to Vicksburg, while Gen. William T. Sherman remained for two days to destroy roads, bridges, factories, and arsenals.

After the surrender of Vicksburg (July 4), Johnston, who had been maneuvering to strike in the rear while Grant was engaged in the siege, fell back to Jackson. Sherman moved to retake the city and began to shell it on July 11, hitting

every part of town. The siege was prosecuted night and day, and on the morning of July 17, Jackson was found evacuated, General Johnston having retreated. General Sherman remained five days at Jackson, destroying much property, and then returned to Vicksburg. The Union loss at Jackson from July 11 to 16 was 129 killed, 762 wounded, and 231 missing or captured. The Confederate loss from July 5 to 25 was 71 killed, 504 wounded, and 764 captured or missing.

JACKSONVILLE, city, Alabama, in Calhoun County; altitude 720 feet; on the Southern Railroad, 18 miles southeast of Gadsden. Situated in a cotton and dairying region, the city's chief industries are the manufacture of cotton fabrics and yarn. A state teachers college is located here. The town was settled in 1822. Pop. 5,678.

JACKSONVILLE, city and port of entry, Florida, seat of Duval County, in the northeastern corner of the state, on the west bank of the St. Johns River, 20 miles from the ocean by water and 14 miles by land; altitude 20 feet. It is an important trading port and one of the leading railroad, air, and motor freight centers in the South. It is 138 miles south of Savannah, 212 north of Tampa, 165 east of Tallahassee, and about 1,000 miles from New York. It is served by the Seaboard Air Line, the Atlantic Coast Line, the Florida East Coast, and the Southern Railway System.

The port enjoys a strategic geographical position with respect to ocean routes to South America, Panama, and the Far East, and is usually the last port of call for vessels bound to those countries from ports northward on the Atlantic Coast. It has an excellent harbor on the Saint Johns River, sheltered from all storms and open to navigation throughout the year. The mean tide range is about 13 inches, with tidal currents not of sufficient strength to affect shipping adversely. The control of the port is vested in the City of Jacksonville, a commission of five men having supervision and control of the municipal terminals with power to extend and improve them, as well as to fix the rates and charges for their use. In 1950 there were 81 piers, wharves, and terminals at the port of Jacksonville, of which 65 were owned and operated by private interests. These provide more than 8 miles of vessel berthing space with water depths alongside up to 34 feet at mean low water, which is the channel depth. In 1950 work was begun on the Dames Point-Fulton Cut-off Channel which would materially shorten the distance from the ocean to the harbor.

Commerce and Industry.—Jacksonville's industrial activities show remarkable expansion since 1940. Wood and metal-working plants produce lumber, furniture, millwork, boxes, paper, and machinery. Other manufactures include naval stores, cigars, concrete blocks, glassware, fertilizers, and feeds. The processing of citrus fruits and meat products, and boat building and fishing are also important occupations. The growing tourist trade provides one of the city's major sources of income, and the selection of Jacksonville as the site of a large naval training station in 1940 has added further to city development.

Cultural Facilities.—In addition to primary, secondary, parochial, and private schools, Jacksonville has a junior college and a college of

music, the latter offering a four-year course. Other cultural advantages include a public library; a Little Theater group; the Children's Theatre, known as Teen Town, and the Children's Museum; the Art Center, the Garden Center, and the Symphony Society.

Places of Interest.—The Jacksonville Recreation Department has jurisdiction over a large number of widely scattered city areas which provide organized recreation facilities for the city's population. These include tennis courts, soft ball diamonds, swimming pools, and golf courses. The excellent freshwater and saltwater fishing attracts both residents and visitors. The city has an annual \$10,000 fishing tournament open to all comers. There is a free zoo overlooking Trout River, and two dog-racing tracks provide entertainment. The enormous Gator Bowl is the scene of the New Year's Day football game.

Government and History.—The city's government is a combination of the mayor-council and the commission types. The early history of Jacksonville is the story of the river on whose banks the city stands. The French naval officer Capt. Jean Ribaut placed a stone column beside the mouth of the river in 1562. In 1564 a Huguenot colony built Fort Caroline at St. Johns Bluff, a few miles upriver. The next year the Spanish mariner Pedro Menendez de Avilés, then adelantado of Florida, destroyed the little French colony. During the 18th century the English slave hunters were raiding the Florida missions repeatedly and by 1763 they had become masters of Florida.

The first settlement on the present city site was made by Lewis G. Hogan in 1816, whence Hogan's Creek, dividing the city, is named. In 1822 the town was laid out and named in honor of Andrew Jackson, the first territorial governor of Florida. It was incorporated in 1833.

Population.—The Seminole War (q.v.) greatly retarded the development of Jacksonville, but at conclusion of hostilities in 1842 a steady growth took place. The population in 1910 numbered 57,699; in 1930 (including South Jacksonville), 135,146; and in 1960, 201,030.

JACKSONVILLE, city, Illinois, seat of Morgan County; altitude about 600 feet; on the Burlington, the Wabash, and the Gulf, Mobile, and Ohio railroads; 34 miles southwest of Springfield. The principal crops of the county are corn, wheat, oats, soybeans, and hay. The city's principal industries are the manufacture of textile goods, Ferris wheels, electric appliances, food products, and steel bridges; also book binding. Jacksonville has a public library, two college libraries, and an art museum. It is the home of Illinois College, founded in 1829, and of MacMurray College for Women. When established in 1846, MacMurray College was known as the Illinois Conference Female Academy and was sponsored by the Methodist Episcopal Church. It has ceased to be denominational. Courses are offered in music, fine arts, and home economics, in addition to the ordinary academic subjects. The city is also the seat of state schools for the blind and the deaf, and a state mental hospital.

Jacksonville played a prominent part in the development of culture in Illinois as well as in the state's political history, and it was one of the first communities in Illinois to enjoy the advantages of railroad transportation. Here Stephen A. Douglas and William Jennings Bryan began their

careers in the practice of law; the site of Bryan's home is marked. Duncan Park is named in honor of Gov. Joseph Duncan, head of the state government from 1834 to 1838; he moved to Jacksonville in 1830, and died there. The site of another home, that of Col. John J. Hardin, is marked as the birthplace of Col. Hardin's daughter, Ellen Hardin Walworth, who was one of the three founders of the Daughters of the American Revolution. An interesting point in Jacksonville is the Corner of the Four Churches, a street intersection with a church at each corner. Notable buildings are the courthouse, the federal building, the city hall, the American Legion Memorial Home, the Masonic Temple, and the state institutional buildings. The origin of the city's name is somewhat obscure, but the most probable tradition seems to be that it was selected in honor of Andrew Jackson. First settled about 1818, the city was platted in 1825, and incorporated in 1830. In 1837 it contended for the honor of selection as capital of the state. Before the Civil War it was a station on the Underground Railroad. The city's government is administered by mayor and council. The water, power, and lighting systems are under municipal ownership. Pop. 21,690.

JACKSONVILLE, town, North Carolina, Onslow County seat, on the New River, 36 miles south of Kinston. It is a popular resort, with fishing. Camp Lejeune, the United States Marine base, is 10 miles southeast of the town. Pop. 13,491.

JACKSONVILLE, city, Texas, in Cherokee County; altitude 515 feet; served by the Missouri Pacific, the St. Louis Southwestern, and the Southern Pacific railroads; about 120 miles southeast of Dallas. Situated in a productive agricultural area, the town is a trading and shipping center. The principal crop of the area is tomatoes which are shipped to markets in the United States and Canada. Industries include basket, box, and garment factories, canneries, and cotton presses. Lon Morris College and Jacksonville College are situated here. The city also has a public library and several parks. First settled on the present site about 1872, Jacksonville was incorporated as a city in 1930. It has commission government with a city manager. The water supply system is publicly owned. Pop. 9,590.

JACKSONVILLE BEACH, city, Florida, in Duval County; on the Atlantic Ocean, 15 miles east of Jacksonville. It is noted as a beach resort; there is also a concrete industry. The city was incorporated in 1907. It has council-manager government. Pop. 12,049.

JACMEL, zhâk-mě'l, seaport, Haiti, in the Ouest Department, on the south coast of the republic, on Jacmel Bay, about 25 miles southwest of Port-au-Prince. Vessels anchor offshore. There is regular steamer communication with American and English ports. A commercial center, it ships bananas, coffee, and other products of this fertile agricultural region. There are manganese deposits near by. Pop. (1950) 8,545.

JACOB, from Hebrew word *Ya-aqob*, literally "to seize the heel," or "supplant," also called Israel, third patriarch and son of Isaac and Rebekah. The story of his life as told in Genesis has many dramatic incidents. The strug-

gle before birth between the two brothers, their antagonism due to the episode of the birthright and later to the subterfuge whereby Jacob secured his father's blessing, Esau's deadly hatred, the wanderer's dream and Jacob's fleeing to safety, his marriage with Laban's daughters, how his quiet life was disturbed and again he became a pilgrim; the vision of the wrestling angel, his reconciliation with Esau and subsequent arrival at Hebron, where his parents lived, with his twelve sons, fathers of the ten tribes of Israel—all these events can be read and read again without losing their interest. The resemblances throughout the careers of the patriarchs—brotherly strife, parental overfondness and the rest, only emphasize the human quality of the narrative.

After ten years, as the closing chapters of Genesis inform the reader, Jacob's favorite son, Joseph, became leading actor in the drama. In their anger at his airs of superiority, his brothers sell him to a band of Ishmaelites, telling Jacob that a wild beast had devoured him. Later, as Canaan was visited by a severe famine, the sons were sent to Egypt to buy corn, Benjamin being retained at home, but Jacob was obliged to let him go with the rest, as Joseph had refused otherwise to release Simeon held as hostage. How Jacob heard on the second return of his sons from Egypt that Joseph was ruler, how he set out to meet him, with a retinue of 66 persons, 11 sons and their children, and how Joseph met him at Goshen, to be received later by Pharaoh and assigned a residence "in the best part of the land, in the land of Rameses," complete a thrilling narrative. At that time, Jacob was 130 years of age. His death was the next great episode, but before his passing he made Joseph swear not to bury him in Egypt, but in the family sepulchre in Canaan. Then adopting Joseph's two sons, he blessed all his sons in solemn assembly, giving Joseph's younger son precedence over the elder and assigning to Joseph a portion more than his brothers. He was 147 at his death, his body being embalmed in Egyptian fashion. It was accompanied back to Canaan by an immense retinue including all the servants of Pharaoh and all the elders of Egypt and was laid at rest in the cave of Machpelah at Hebron.

The story of Jacob, as can be said of the other patriarchs, has been attacked as unhistorical, a charge easily made, if not substantiated. It is, however, a source-book of evidence on marriage customs, pastoral occupation, belief and traditions of the people, which must have had a basis of fact to be related with such naturalness and simplicity. The olden rabbis in their popular expositions of the Bible or "midrashim" realize their value for character building. Jacob is a favorite theme, and the homilies, however apparently trivial at times, had their significance in keeping alive the study of Scripture. Much that seems obscure and of doubtful worth in the text receives fresh meaning. Take the story of the birthright, for example. Esau was fresh from the slaying of Nimrod and two of his companions, when he sold the birthright. In desiring it, Jacob wished chiefly its spiritual prerogatives. It is another opinion that Jacob wanted the birthright, because the first born was forerunner of the priest who offered the family sacrifices and he felt that Esau was not fit to bring offerings to God. How the Midrash enlarges upon Scripture is

illustrated by the statement that Jacob gave three injunctions to his sons before his death. They should not worship idols, nor blaspheme the name of God, nor permit a pagan to touch his corpse. On each side of his coffin, three of his sons were to be stationed, just as the tribes were later gathered in the wilderness. Joseph's order to have Jacob's body embalmed was not regarded with favor; it seemed to indicate a limitation of divine power.

ABRAM S. ISAACS.

JACOB, John, British soldier and colonial administrator. b. Woolavington, Somerset, Jan. 11, 1812; d. Jacobabad, India, Dec. 5, 1858. Commissioned in the East India Company's service in 1828, he participated in the Afghan War of 1838 and many Indian frontier operations. Political superintendent and commandant of the frontier of Upper Sind in 1843, he suppressed marauding tribesmen. A brilliant cavalry leader, he invented an improved rifle, to be used with an explosive bullet, also of his invention. The year of his death he was authorized to raise two infantry regiments to be called "Jacob's Rifles" and to be armed with the weapon he invented. Among General Jacob's publications are *Large map of Cutchee and the north-west frontier of Scinde* (London 1848); *Record Book of the Scinde Irregular Horse*, 2 vols. (London 1853, 1856); *Tracts on the Native Army of India, its Organisation and Discipline* (London 1857).

JACOB, Joshua, Irish founder of the "White Quakers": b. Clonmel, County Tipperary, c.1805; d. Wales, Feb. 15, 1877. By birth a Quaker, he was disowned by the Society of Friends in 1838. He then formed a religious society of his own which, commencing in 1843, held a yearly meeting in Dublin. Because of their practice of wearing only undyed garments they were called "White Quakers." The sect condemned the use of clocks, watches, bells, and newspapers. Accused of misappropriating the property of orphans of whom he was guardian to use for the furtherance of his religious experiments, Jacob was sued in chancery court for recovery of the funds and received a prison sentence of two years for contempt of court. About 1849 he established a community at Newlands, near Dublin. The members made bruised grain their staple diet and abstained from flesh foods. On the death of his wife, from whom he was separated, he married a Roman Catholic and reared a large family in that faith.

JACOB BEN CHAYYIM BEN-ISAAC IBN-ADONIA, Jewish author: b. Tunis about 1470; d. Venice about the middle of the 16th century. Soon after the year 1500 the Jews of Tunis were severely persecuted. He fled to Italy and lived in Rome, Florence and Venice. At Venice he found employment as proofreader on the Bamberg edition of the Rabbinic Bible which was prepared under the direction of Felix Pratensis. The second edition (4 vols., Venice 1524-1525) was prepared by Jacob ben Chayyim. It is noted for the amount of erudition displayed, especially in connection with the Masorah. It contains the text, with the Masorah, the Targums, the Commentaries of many Jewish scholars including his own.

JACOBA or JACQUELINE, OF BAVARIA or OF HOLLAND, countess of Hol-

land, Zeeland and Hainault: b. July 25, 1401; d. Teilingen castle, near Sassenheim, South Holland, Oct. 6, 1436. The only child and heiress of William IV, duke of Bavaria and count of Holland, Zeeland, and Hainault, she was married as a child to John of Touraine, second son of King Charles VI of France, who became dauphin on the death of his older brother Louis. The death of John in April 1417, and of Jacoba's father two months later, left the young widow an heiress of vast estates. Her uncle John the Fearless, duke of Burgundy, married her to her cousin John IV, duke of Brabant in 1418. However, another uncle, her father's brother John of Bavaria, bishop of Liège, contested her inheritance. In 1419, through the mediation of John the Fearless, a treaty of partition was made between the rapacious prelate and his niece. But this did not satisfy the uncle who, on April 21, 1420, extorted from her weak husband possession of Holland and Zeeland.

Later that year Jacoba took refuge in England where she was granted a court pension and was one of the godmothers of Henry VI. Pedro de Luna, the Spanish antipope who maintained his title of Benedict XIII, annulled her marriage with Brabant, and in the autumn of 1422 she married, as third husband, Humphrey, duke of Gloucester (1391-1447). Politically the marriage was very injurious to English ambitions for hegemony in the Netherlands, since it placed Gloucester in opposition to Philip, duke of Burgundy, who had succeeded his murdered father in 1419 and the following year had concluded an alliance, the Treaty of Troyes, with Henry V of England. The Anglo-Burgundian alliance against France was thus imperiled. Gloucester and his older brother John, duke of Bedford, now endeavored to obtain from Pope Martin V a legitimization of the marriage; but before any papal decision had been reached Gloucester and Jacoba crossed to Calais in October 1424, with 5,000 troops, bent on reconquering Hainault (the modern Belgian province of Hainaut and French Department of Nord). Marching through Burgundian territories unopposed, they took peaceable possession and, on December 4, the estates of Hainault recognized Gloucester as their count.

Philip at once concluded a truce with France and challenged Gloucester to a duel. On the pretext of preparing for it Humphrey returned to England with Eleanor Cobham, his latest mistress, leaving Jacqueline to be captured on June 25, 1425 when Philip overran Hainault. In September Jacqueline escaped to Holland which she defended with the support of the Hoek faction. Humphrey sent her a reinforcement of 500 English, but lost interest in her fortunes after Philip had defeated her at Brouwershaven in June 1426. The pope annulled her marriage with Humphrey in January 1428. In July she was forced to sign the Treaty of Delft with Philip which authorized him to administer Holland, Zeeland, and Hainault, declared him her heir should she die childless, and allowed her only her title of countess. She also promised never to marry without Philip's consent.

In need of funds, Philip in 1430 mortgaged Holland and Zeeland to the Borsselen family. In a final effort to recover her lost inheritance Jacqueline early in 1432 secretly married its head, Frans van Borsselen, and initiated a rising in Holland against the Burgundians. Philip immediately invaded the country, captured her hus-

band and demanded as a condition of his liberation that she abdicate her three countships, retaining only her title of duchess of Bavaria. She submitted in April 1432 and two and a half years later died on her husband's estate, childless. Duke Philip of Burgundy, her heir, thus became lord of the Netherlands.

JACOBAN FURNITURE. See FURNITURE.

JACOBI, jä-kō'bī, Abraham, German-American physician: b. Hartum, Westphalia, May 6, 1830; d. Lake George, N. Y., July 10, 1919. He studied at Greifswald, Göttingen and Bonn, and graduated M.D. at Bonn University in 1851. Those were years of revolutionary ferment in Germany and Jacobi, becoming identified with the movement, was imprisoned for "high treason" at Berlin and Cologne (1851-1853). In 1853 he settled in practice in New York, where his abilities soon brought him into notice. He was appointed professor of diseases of children at the New York Medical College (1860-1865) and held a similar chair in the medical department of the University of the City of New York (1865-1870). Some years later he became professor of the diseases of children at the College of Physicians and Surgeons. He held many important appointments, and was president of the New York State Medical Society (1882); of the New York Academy of Medicine (1885-1889); in 1896 was president of the Association of American Physicians, and in 1912 president of the American Medical Association. In 1900 his 70th birthday was the occasion of a public demonstration in his honor.

Among his works are *Dentition and its Arrangements* (1862); *Infant Hygiene* (1873); *Diphtheria* (1880); *Therapeutics of Infancy and Childhood* (1895); *Aufsätze, Vorträge, und Reden* (1893); *Collectanea Jacobi*, 8 vols. (1909).

JACOBI, yä-kō'bē, Friedrich Heinrich, German philosopher and writer: b. Düsseldorf, Jan. 25, 1743; d. Munich, March 10, 1819. He was educated at the University of Geneva, and in 1764 entered upon a commercial career in his native town; after a few years he retired from business, and in 1770 became a member of the councils for the duchies of Juliers and Berg. From his university days he was actively interested in literature and philosophy, and with Wieland started a journal in which some of his own writings were first published. In 1779 he went to Munich for a short time; and in 1793 left Düsseldorf and settled in Holstein. In 1804 he was called to Munich as a member of the Academy of Sciences then newly established; from 1807 to 1812 he was president of the academy; and in 1812 retired to prepare a collected edition of his works, which, however, was not finished before his death.

His writings include two philosophical romances, *Allwells Brief-Sammlung* (1774) and *Woldemar* (1779); and the more important philosophical treatises, *Briefe über die Lehre Spinozas* (1785); *David Hume über den Glauben oder Idealismus und Realismus* (1785); *Von den Göttlichen Dingen* (1811). In these treatises he defines his theory that man's thought—or reason—is by its nature partial and limited, and can only connect facts, not explain their existence; and that the higher truths must be understood

through another different faculty which he calls "faith" or "belief" ("Glaube"), he does not, therefore, seek to establish a systematic philosophy. His theories involved him in considerable controversy, especially with the adherents of the critical philosophy. His collected works were published at Leipzig, 6 vols. (1812-1824).

JACOBI, Hermann Georg, German Sanskrit scholar: b. Cologne, Feb. 11, 1850; d. Bonn, Oct. 19, 1937. He was educated at Cologne Gymnasium, and later took up a course of studies in Sanskrit and allied languages at the universities of Bonn and Berlin. After spending a year (1872-1873) in the India office in London on the old Sanskrit manuscripts, he went to India, making a tour of Rajputana. In 1875 he became a docent in Sanskrit at Bonn; from 1876-1885 was professor extraordinarius of Sanskrit and Comparative Philology at Münster, Westphalia; in 1885 was made professor ordinarius of Sanskrit at Kiel; and in 1889 was appointed professor of Sanskrit at Bonn. He made a special study of Jainism and Prākṛit grammar, writing exhaustively on those subjects as well as on the Sanskrit poetical languages. Among the most important of his works are *The Indian Antiquary* and the *Epigraphia Indica*, published in 1892, in which he gives two sets of tables showing the Hindu dates in inscriptions.

His other works include *De Astrologiae Indicae, Horā appellatae originibus* (1872); *The Kalpasūtra of Bhadrabāhu* (1879); *The Ayaṅga Sūtra of the Cvetāmbara Jains* (1882); *Gaṇa Sūtras* (1884); *Ausgewählte Erzählungen im Māhārāshtri. Zur Einführung in das Studium des Prākṛit* (1886); *The Porisishataparvan by Hemachandra* (1891); *Sthavirāvali Charita* (1891); *Das Rāmāyana Geschichte und Inhalt, nebst Concordanz der gedruckten Recensionen* (1893); *Kompositum und Nebensatz* (1897); *Bhāsa's Svapnavasayadatta* (1913); *Die Entwicklung der Gottesidee bei den Indern und deren Beweise für das Dasein Gottes* (1923).

JACOBI, Karl Gustav Jakob, German mathematician: b. Potsdam, Dec. 10, 1804; d. Berlin, Feb. 18, 1851. He obtained his education at the University of Berlin, where he studied especially mathematics and philosophy, later in 1824 becoming a privat-docent there. In 1825 he became assistant professor of mathematics at Königsberg and in 1827 was appointed professor. He was appointed a member of the Prussian Academy of Sciences in 1836 and from 1842 till his death in 1851 lectured at the University of Berlin. His most important work was on the theory of elliptic functions, but he also made some valuable contributions to the theory of numbers and determinants.

Only a small portion of his writings and lectures were published during his lifetime and the greater part of these were published in the *Crelles Journal*. Among these are *Fundamenta Nova Theoriae Functionum Ellipticarum* (1829); *Canon Arithmeticus* (1839); *De Formatione et Proprietatibus Determinantium* (1841); *Mathematische Werke* (1846-1871). A complete edition of his works, *Gesammelte Werke*, was published in seven volumes by the Berlin Academy of Sciences (1881-1891). His *Vorlesungen über Dynamik* did not appear until 1866, long after his death, and later in 1895, his essay, *Über die vierfach periodischen Functionen*

Zweier Variabeln, was published in Latin.

JACOBI, Mary Corinna Putnam, American physician: b. London, England, Aug. 31, 1842; d. New York, N. Y., June 10, 1906. She was the first woman to graduate from the New York College of Pharmacy in 1863, and from the Woman's Medical College of Philadelphia, Pa., in 1864. After a brief period of teaching she went to Paris, France, and spent 18 months in hospitals there and was finally admitted to the École de Médecine, the first woman to be accepted by the faculty. Upon completion of her studies she returned to the United States and entered private practice and in addition lectured on therapeutics in the Woman's Medical College of the New York Infirmary. In 1873 she was married to Dr. Abraham Jacobi (q.v.). In 1874 she organized, and became president of, an association for the advancement of medical education for women. She was the first woman to become a member of the New York Academy of Medicine. Her writings on medical subjects were important. They include, *The Value of Life* (1879); *Cold Pack and Anaemia* (1880); *The Prophylaxis of Insanity* (1881); *Essays on Hysteria, Brain Tumor, and some Other Cases of Nervous Diseases* (1888).

JACOBI, yā-kō'bē, Moritz Hermann, German physicist, architect, and engineer: b. Potsdam, Germany, Sept. 21, 1801; d. St. Petersburg (now Leningrad), Russia, March 10, 1874. A brother of Karl Gustav Jakob Jacobi, he began his career as an architect but is chiefly remembered for his studies of the uses of electricity. He made his first trip to Russia at the age of 17 and was to spend much of his life in or near the imperial city of St. Petersburg.

Designing an electric telegraph in 1832, he may have been the first to suggest the so-called ground return circuit, in which ground replaces the return wire. He claimed the discovery of galvanoplasty in 1837, invented an electrotyping process in 1839, proposed the use of a copper wire of fixed dimensions as a unit of electrical resistance, and conducted fruitful researches on the operation of dynamos and motors and the application of electricity as motive power.

He was professor of architecture in 1834 at the University of Dorpat in what was then the Russian province of Estonia. From 1839 he was a member of the St. Petersburg Academy of Sciences. He left numerous scientific writings in German and French, including *Mémoire sur l'application de l'électro-magnétisme au mouvement des machines* (1835); *Die Galvanoplastik* (1840); and *Mémoire sur la théorie des machines électro-chimiques* (1851).

JACOBINS, jāk'ō-bīnz, a political party of the French Revolution founded by liberal members of the National Assembly at Versailles in the summer of 1789. Its originators were chiefly Breton deputies, hence it was first called the Club Breton, later adopting the title Société des Amis de la Constitution. Not until after the National Constituent Assembly removed to Paris in October and occupied the Palace riding-school in the rue Saint-Honoré did the members acquire their historic appellation of Jacobins. The club found convenient Paris quarters adjoining the Assembly in an old Dominican monastery, and as "Jacobin" had for centuries been a synonym for

Dominican, it was natural that opponents should refer to the new occupants flippantly as "Jacobins." The "Friends of the Constitution" soon themselves adopted the name and called their organization the Club des Jacobins.

At that early stage of the revolution the Jacobins numbered among their members the Abbé Grégoire, Mirabeau, Robespierre, the painter Louis David, Antoine Barnave, Adrien Duport, M. J. Chénier, J. F. de Laharpe—and such aristocrats of moderate views as Louis Philippe, duc de Chartres, the duc d'Aiguillon, the prince de Broglie, the vicomte de Noailles, and those brother veterans of the American War of Independence, the comtes de Lameth. Gradually the club's political tendencies became more and more radical, and the moderate members, who wished to preserve the monarchy, resigned or were expelled, some of them in 1791 founding the Club des Feuillants. The majority choosing republicanism were dominated by Robespierre and his friends.

After the fall of the monarchy, in September 1792, the club called itself the Société des Jacobins. Now the most radical and influential political machine in France, it had affiliated clubs in all, or nearly all, the departments, so that party decrees in Paris were obeyed throughout the country, the Convention itself becoming a mere tool of the Jacobins.

The soul of Jacobin leadership and of the Terror was the "incorruptible" Robespierre. His arrest by the Convention on the 9th Thermidor (July 27, 1794) foreshadowed the party's eclipse. The club was ordered closed the following November 11. The Thermidorean reaction set in and a white terror succeeded the Jacobin red. There were several attempts to revive the club under other names, but Jacobin influence declined progressively until by 1799 it had virtually disappeared.

The term "Jacobin" has ever since been used to designate a violent radical or turbulent demagogue.

Bibliography.—All histories of the French Revolution devote considerable space to the Jacobins. Their proceedings were published contemporaneously in four volumes as *Journal des Amis de la Constitution* (Paris 1793–95). The basic historical work is Aulard, F. A., *La Société des Jacobins*, 6 vols. (Paris 1889–95). See also Mallet, G., *La Politique Financière des Jacobins* (Paris 1913); Brinton, Crane, *The Jacobins* (New York and London 1930).

JACOBITE CHURCH, jāk'ō-bit, one of the Monophysite sects originating in the early Christian Church and considered heretical by both Greek Orthodox and Roman Catholic communions. Its 6th century eponymous founder was Jacobus Baradaeus (d. 578) who established it in Syria, greatly assisted by the Empress Theodora. She is said to have influenced his appointment in 543 as bishop of Edessa (modern Urfa, Turkey); thereafter he was the undisputed leader of the Monophysites (q.v.) and a zealous propagator of their doctrine. The church now has communicants in Iraq and India as well as Syria. Its rite is the Antiochene or West Syrian, and the language of the liturgy is Syriac. The patriarch of Antioch, its head, lives at Homs (ancient Emesa) in western Syria. Since the 17th century the Jacobites have been in continuing contact with Rome, and a portion of them, estimated as about half, are in communion with the pope. The head of these "Syrian Catholics," as they are called, also has the title of patriarch of Antioch; his residence is in Beirut, Lebanon. The

sect known as "Malabar Jacobites" in Malabar, India, comprise mainly descendants of 17th century Roman Catholic converts. However, a large number of 20th century Malabar Jacobites have entered into communion with Rome while retaining their liturgy and customs.

Consult Attwater, Donald, *Christian Churches of the East*, 2 vols. (St. Paul, Minn., 1947-48).

JACOBITES (from Latin *Jacobus*, i.e., James), a political party in Great Britain the members of which, after the revolution of 1688 and accession of William and Mary, continued to regard the dethroned King James II as the rightful king of Great Britain and Ireland. After James's death in exile in 1701 the Jacobites espoused the cause of his son by Mary of Modena, James Francis Edward Stuart (1688-1766), who assumed the title of James III and VIII, and was known to the supporters of the Hanoverian dynasty as the Old Pretender. His eldest son, Prince Charles Edward Stuart (1720-1788), was called by them the Young Pretender, and by his partisans the Young Chevalier and Bonnie Prince Charlie. Most romantic of all the Stuart pretenders, he captured the imagination of his fellow Scots during his attempt to regain the throne of his ancestors in the famous Jacobite rising of 1745, but he died a drunken debauchee. The Jacobites then gave their allegiance to Charles Edward's younger brother, Henry Benedict Maria Clement Stuart, Cardinal York (1725-1807), last prince of the British royal house of Stuart, who assumed the title of King Henry IX of England. Impoverished by the French Revolution, King George III took pity on this clerical claimant to his throne and granted him a substantial pension.

As a party the Jacobites won more adherents in Scotland, the homeland of the Stuarts, than in England; but they were even more strongly entrenched in Ireland because of James's Roman Catholicism, the accession of Protestant William and Mary bringing the religious issue to the fore. The first attempt of the Jacobites to restore James to the throne followed by only a few months his flight to France. King Louis XIV assisted his unfortunate cousin with a fleet and army to occupy Ireland; but after the defeat of the Franco-Irish forces at the Battle of the Boyne (July 1, 1690), no further aid was offered by Louis to the exiled king.

During the 18th century four more attempts were made at a Stuart restoration which, had any succeeded, would have brought the Old Pretender to the throne. The first of these occurred in 1708 when Comte Claude de Forbin with a small fleet attempted to convey the "Chevalier de Saint-George" (James Francis) to Edinburgh; the fleet reached the Firth of Forth but was driven away. George I, first of the Hanoverian monarchs, ascended the throne in 1714. A year later the earl of Mar headed a Jacobite rising in the north, but failed to take advantage of the synchronous risings in England of Thomas Forster and Lord Derwentwater, they too having raised the Pretender's standard. Had Mar led his Scots into England and joined the English Jacobites, the uprising might at least have attained serious proportions. As it was, both forces capitulated the same day, Nov. 13, 1715, the English at Preston and the Scottish at Sheriffmuir. After the débâcle James Francis landed, but six weeks later was obliged to return to France. The third attempted occurred in 1719 when Cardinal Giulio

Alberoni, prime minister of Spain's Philip V, sponsored an expedition which landed in Scotland. Lacking a united leadership it was easily defeated at Glenshiel on June 10.

The fourth and last of the 18th century Jacobite risings was the most famous, the "45" led by Prince Charles Edward, as his father's representative. Landing in Scotland in 1745 with only seven followers, he secured the support of the Highland chieftains who called out their clans. Perth and Edinburgh were occupied. Gen. Sir John Cope was defeated at Prestonpans on September 21, and the prince started his march on London. However, anticipated support both in the Lowlands and in England failed to materialize. On reaching Derby his generals advised a retreat. Though he gained one more victory, at Falkirk (Jan. 21, 1746), he was finally defeated at Culloden (April 16). For five months after the collapse of his cause Prince Charles lived a hunted life in the Highlands, with a price on his head, before escaping to France. The rebellion was put down with brutal severity by the duke of Cumberland, and three of the rebel lords, tried by their peers in the House of Lords, were condemned and beheaded. Many lesser leaders were hanged or transported. Antipathy to the Hanoverians diminished after the accession of George III, the first British-born sovereign of that house, and his generosity to the last surviving Stuart claimant, Cardinal York, still further diminished the numbers of Jacobite partisans. It may be said that as early as the first years of Victoria's reign Jacobitism in Great Britain had become little more than a romantic memory.

Consult Petrie, C. A., *The Jacobite Movement*, 2 vols. (London and New York 1948-50).

JACOBS, ja'kübz, **Helen Hull**, American tennis player and writer: b. Globe, Arizona, Aug. 6, 1908. Educated at the University of California at Berkeley, she was the national junior tennis champion in 1924-1925 and went on to an outstanding career in amateur lawn tennis. She was the first player to win the national women's singles crown at Forest Hills, Long Island, for four successive years (1932-1935), won the unofficial world singles title at Wimbledon, England, in 1936, where she was a finalist on six separate occasions, won several doubles and mixed doubles championships and played on the American Wightman Cup team for 13 straight years. She served as an officer in the Women's Naval Reserve during World War II and was the author of several books and magazine articles about tennis.

JACOBS, ja'kübz, **Henry Eyster**, American Lutheran clergyman and theologian: b. Gettysburg, Pa., Nov. 10, 1844; d. Philadelphia, July 7, 1932. He was graduated from Pennsylvania College (Gettysburg) in 1862, and from the Lutheran Theological Seminary at Gettysburg in 1865. From 1864 to 1867 he was a tutor at Pennsylvania College, and from 1867 to 1868 home missionary in Pittsburgh. He was principal of Thiel Hall, Water Cure, Beaver County, Pa., from 1868 to 1870. He was professor of Latin and history in Pennsylvania College in 1870-1880, of ancient languages in 1880-1881, and of Greek in 1881-1883. He was professor of systematic theology, Lutheran Theological Seminary, after 1883; dean, 1894-1920; president, 1920-1927; and emeritus thereafter. He was president of the Board of Foreign Missions of the General Council of the Lutheran

Church (1902-1907); and president of the General Conference of Lutherans (1899, 1902, and 1904). His writings covered various phases of religion and church history, including *A History of the Lutheran Church in America* (1893); *Life of Martin Luther* (1898); and *The German Emigration to America, 1709-1740* (1899).

JACOBS, William Wymark, English writer: b. London, England, Sept. 8, 1863; d. there, Sept. 1, 1943. While working as a post office clerk he wrote humorous short stories, many of them centering about the locale of the London docks which he knew as a boy. At first the stories appeared in the magazines *Idler* and *Today*, but Wymark's first collection, *Many Car-goes* (1896), was successful enough for him to leave the civil service and devote himself to writing. Among his later books, chiefly collections of short stories, were *The Skipper's Wooing* (1897), *Sea Urchins* (1898), *The Lady of the Barge* (1902), *Captains All* (1905), *Night Watches* (1914), and *Sea Whispers* (1926). An omnibus of previously published stories, *Snug Harbor*, appeared in 1931. Of all the narratives, Jacobs' best is a tale of horror, *The Monkey's Paw* from *The Lady of the Barge*; it was dramatized in 1904 as a one-act play by Louis Parker. Jacobs himself wrote a few short plays, some of which were based on his stories. He has been called "the O. Henry of the waterfront."

JACOB'S LADDER, jă'kûzb lăd'ēr, a common name for species of *Polemonium*, a genus of some 30 species of usually perennial herbs in the family Polemoniaceae, widely distributed in the northern hemisphere and southward to Chile in the Americas, and especially the common garden species, *P. caeruleum*. This species is an erect plant 8 to 30 inches tall, with a hollow, angled stem and alternate, pinnately compound leaves with about 27 leaflets each. It bears many blue, bell-shaped flowers, each nearly an inch long, in a terminal panicle. There are five lobes on the calyx and corolla, five stamens, and a three-parted ovary. It is a hardy plant useful for rock gardens and borders.

RICHARD M. STRAW.

JACOBSEN, yă'kôp-s'n, Jens Peter, Danish novelist: b. Thisted, Denmark, April 7, 1847; d. there, April 30, 1885. He entered Copenhagen University in 1867 to study the natural sciences, but writing claimed much of his attention. In 1869 he had written a volume of poetry, which, however, remained unpublished until its inclusion in the posthumous *Digte og udkast* (*Poems and Sketches*, 1886; the *Poems* in Eng. tr., 1920). About 1870 he became interested in the theories of Charles Robert Darwin and in 1872 published a translation of Darwin's work, *On the Origin of Species by Means of Natural Selection*, following it with a translation of *The Descent of Man* in 1874 and 1875. Although he had been reared in Christianity, he began to question religious belief and finally became a complete atheist.

In 1873 it was discovered that Jacobsen had contracted tuberculosis, and he was given two years to live. By conserving his strength he stretched the allotted time to over 11 years, during which he abandoned science, confined himself to writing, and became one of the foremost exponents of the naturalistic movement in Danish

literature. In 1876 appeared *Frû Marie Grubbe* (Eng. tr., *Marie Grubbe*, 1914), a historical romance. His second and last novel, *Niels Lyhne* (1880; tr. into English as *Siren Voices*, 1896, and *Niels Lyhne*, 1919), was a study in the decadence of an individual, a man who, like Jacobsen, was an atheist. His complete works were published posthumously as *Samlede værker*, 5 vols. (1924-29). Jacobsen was one of Denmark's foremost prose stylists, clothing the most minute descriptions in the most exquisite lyricism, possessing great sensitivity and analytical power. See also DANISH LITERATURE.

Consult Gustafson, Alrik, *Six Scandinavian Novelists* (New York 1940).

JACOBUS DE VARAGINE or **VORAGINE**. See GOLDEN LEGEND.

JACOPONE DA TODI, yă-kô-pô'nâ dă tō'dé (originally JACOPO DEI BENEDETTI), Italian friar and religious poet: b. Todi, Italy, about 1230; d. Collazone, near Perugia, Dec. 25, 1306. A wealthy and successful lawyer, in 1268 he abandoned his profession after his wife's death, gave his property to the poor, and adopted a life of penance, attacking from time to time the licentiousness of the age. In 1278 he became a lay brother of the Order of St. Francis. Siding with the Colonna faction against Pope Boniface VIII, he was taken captive in 1298 and imprisoned until the death of Boniface in 1303. A collection of Friar Jacopone's hymns, *Laude di Frate Jacopone da Todi*, was published in 1490 (reprinted 1910, 1915; rev. ed., 1930). In addition, he is the reputed author of the well-known hymn, *Stabat mater dolorosa*.

Bibliography.—Selected *Laude*, in English as well as the original Umbrian dialect, appear in Evelyn Underhill's biography, *Jacopone da Todi: Poet and Mystic* (London 1919). A fictionalized biography is Helen C. White's *A Watch in the Night* (New York 1933).

JACOTOT, zhă-kô-tô', Jean Joseph, French educator: b. Dijon, France, March 4, 1770; d. Paris, July 30, 1840. Educated at the University of Dijon, he was appointed professor of Latin there in 1789. In the French revolutionary wars he took part in the Belgian campaign of 1792, after which he taught science, mathematics, and Roman law in various institutions. After the final overthrow of Napoleon I he left France for Brussels, where in 1818 he was chosen to teach French at the University of Louvain. Here he perfected the educational method with which he had been experimenting, a system which he described in *Enseignement universel* (*Universal Instruction*), a five-part work published between 1823 and 1839, including methods for learning one's native tongue, foreign languages, the arts (music, design, painting), mathematics, and law and philosophy. He returned to France after the revolution of 1830.

Jacotot's first principle is that all are equal in intelligence; the second, that every person is able to instruct himself, if he will; and the third, that one may learn an entire subject from its parts. Thus, in learning a new language the student might study for himself a short passage: first, the words, then the letters, then the grammar, then the meaning.

JACQUARD, zhă-kâr', Joseph Marie, French inventor: b. Lyon, France, July 7, 1752; d. Oullins, Aug. 7, 1834. As a child he assisted

his father, a weaver in a silk mill. Resolving to make improvements in the loom then in use, in later years he worked at Lyon on an improved model, which he exhibited in Paris at the Industrial Exhibition of 1801. After further improvements had been made at Paris, his perfected loom was bought in 1806 by the state and was declared public property, Jacquard being given an annuity and a royalty on all looms sold. He had eliminated the apparatus of loops and pedals operated by several workers and substituted a simple mechanism which one weaver alone could operate, to weave even the most complex designs. The invention was opposed by the French silk weavers, who feared unemployment, but it was soon generally adopted in France. It is the basis for many adaptations in modern textile weaving. See also WEAVING, HAND LOOM.

JACQUERIE, zhāk-rē', a peasant insurrection against the nobles of France, taking place in 1358 during the period of the Hundred Years' War with England. The name may have come from the word *jacque*, a kind of garment, or from the nickname of the leader, Guillaume Caillet (Cale), called by his men Jacques Bonhomme. More probably it came from the fact that the nobility referred scornfully to a peasant as Jacques. The main cause of the rebellion was the excessive misery caused by the ravages of wandering soldiery, both French and English, after the disastrous Battle of Poitiers in which John II of France was taken prisoner. In this situation the nobles, instead of protecting the peasants, allied themselves with the brigands.

The Jacquerie started in Beauvaisis (Beauvais), then spread to all parts of the Île de France, Picardy, and Champagne. It was conducted with extreme ferocity, many castles being sacked and burned by the peasants. The nobles united with the bourgeois of the towns in a campaign to exterminate the rebels, of whom 7,000 were killed at Meaux by forces under the leadership of Captal de Buch and Gaston III Phoebus, comte de Foix. Bloody reprisals quickly ended the revolt.

PIERRE BRODIN.

JACQUES-CARTIER, zhāk kār-tyā', city, Quebec, Canada, in Chambly County on the right bank of the St. Lawrence River opposite Montreal. It is almost wholly residential, owing its recent growth and incorporation to the expansion of Montreal. Industrial products include processed foods, aircraft engines, and diesel motors. Pop. 40,807.

JADE, yā'dě, a bay of the North Sea, on the north German coast just west of the Weser estuary. Covering an area of over 70 square miles, it was formed by floods in the 13th and 16th centuries. Although shallow at low tide, the bay may be entered by large ships when the tide is high. Its narrow mouth is constantly being widened by storms and erosion. At the west side of the entrance lies Wilhelmshaven, formerly important as a German naval base.

JADE, jād, a name used to designate either of two distinct minerals, jadeite and nephrite, which have been worked into tools by prehistoric peoples in Europe, Asia, and America, and into gems and ornaments in historical times by the Chinese, the Aztecs, the Mayas, and the Maoris of New Zealand. Nephrite is a calcium-mag-

nesium silicate of the amphibole group, having a specific gravity of 2.9 to 3.1; jadeite is a silicate of sodium and aluminum, a pyroxene with a specific gravity close to 3.33. Both are tough, cryptocrystalline materials ranking for hardness at 6½ to 7 on the Mohs scale. When free from extraneous chemicals, both are white, and the great range of shades of green, brown, mauve, blue, yellow, red, gray, and black is accounted for by the presence of various compounds of iron, chromium, or other elements, usually in very small quantities. Nephrite is really a compact



Courtesy American Museum of Natural History

Left: Jade head from eastern Mexico. Right: Jade statue of Buddhist Goddess of Mercy, from Japan.

form of the mineral tremolite or, when iron is present, of actinolite, otherwise known as amphibole asbestos. Specific gravity or other tests are sometimes necessary to identify worked jade as nephrite or jadeite.

The world's best-known deposits of nephrite are in the region of Khotan and Yarkand in central Asia; these have long been China's main source of supply, but in later times have been supplemented from deposits near Lake Baikal in Siberia. China's jadeite is imported from Upper Burma, overland or by sea via Rangoon. The popular apple-green Chinese jewelry jade is made of Burma jadeite. Both minerals have been located in Europe and in North America: jadeite in Guatemala and California, and nephrite in Alaska, British Columbia, California, and Wyoming, where the discovery of a great deposit was reported in 1939. The presence of jadeite in Japan also has been confirmed.

Jade stones, being too hard to be cut by steel, are worked with abrasive sands, chiefly quartz, crushed garnets, and corundum, or in modern times with carborundum. They take a very attractive and durable polish. The carving technique is laborious and makes great demands on the craftsman's patience. Remarkable feats of jade carving were achieved by Aztecs, Mayas, and Maoris with natural abrasives and without the aid of metal tools.

However, it is especially with China that jade carving is associated, for in no other land has this unyielding material been worked so skillfully and in such a long and continuous tradition. From the dawn of their civilization the Chinese have regarded jade as a most precious substance, supremely appropriate for religious objects and for royal and aristocratic insignia and endowed with magical powers of healing and preserving the body and of purifying the mind. Many ancient Chinese jades dating from the 2d millennium B.C. onward are to be seen in leading art museums of the world. The craft of the jade carver came to enjoy a status comparable to that of the goldsmith in the West and had reached a high degree of maturity by the 3d century B.C. The stone became a recognized medium of artistic expression, and exquisite carvings have been produced down to modern times.

Since the discovery in Wyoming, jade has increasingly attracted the attention of lapidaries in the United States, and of at least one sculptor of note, Donal Hord of San Diego, Calif.

Bibliography.—Bushell, Stephen W., Kunz, George F., and others, *Investigations and Studies in Jade*, 2 vols. (New York 1906); Laufer, Berthold, *Jade: A Study in Chinese Archaeology and Religion* (Chicago 1912), 2d ed. (Pasadena, Calif., 1946); Davis, Frank, *Chinese Jade*, 2d ed. (London 1944); Hansford, S. H., *Chinese Jade Carving* (London 1950); *The Seligman Collection of Art*, Vol. 1: *Chinese Bronzes, Jades and Sculptures* (London 1957).

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JAEGER, yā'gēr, a large sea bird related to the gulls, but placed in a separate subfamily, the Stercorariinae, which consists of four species inhabiting the northern seas and the Antarctic. Jaegers vary from about 17 to 22 inches in size and are brown and white in coloration. Their central tail feathers are elongated and their wings are very long and pointed. They are bold and predatory and are equipped with strongly hooked bills and sharp falconlike claws. They occupy at sea the ecological niche occupied by hawks and falcons on land. Three species are found in American waters: the long-tailed (*Stercorarius longicaudus*), the pomarine (*S. pomarinus*), and the parasitic (*S. parasiticus*). See also SKUA.

CHARLES VAURIE.

JAEGERs, yā'gerz, Albert, American sculptor: b. Elberfeld (now part of Wuppertal), Germany, March 28, 1868; d. Suffern, N.Y., July 22, 1925. As a boy he came to the United States. Self-taught in his art, he carved statuary for the Buffalo and St. Louis expositions in 1901 and 1904, also for the Fine Arts Building, St. Louis, and the New York Custom House. By commission of the United States government he executed his best-known monument, that of the Revolutionary hero Baron Friedrich Wilhelm von Steuben in Washington, D.C.

JAEL, jā'ēl, or **JAHEL**, in the Bible, wife of Heber the Kenite and slayer of Sisera, commander of the Canaanites (Judges 4:17-22). The song of Deborah the prophetess praises Jael as "blessed above women" (Judges 5:24-27).

JAEN, hā-ān', province, Spain, part of the Andalusian region in southern Spain. It is bounded by these provinces: on the north by Ciu-

dad Real, on the northeast by Albacete, on the southeast by Granada, and on the west by Córdoba. Its area of 5,209 square miles is traversed by several mountain ranges, including the Sierra Morena to the north, and by the Guadalquivir and Segura rivers.

Jaén's most important industry is mining, the lead mines in the Sierra Morena being the richest in Europe, and there are also iron, copper, gypsum, salt, limestone, and marble. The mining district is served by a network of railways, centering at Linares, the heart of the mining and metallurgical industries. Next in importance is agriculture, carried on in the river valleys and the central and northwestern plains, where the climate is moderate to hot and there is sufficient rainfall. Olive trees, grown in the fertile Guadalquivir Valley, account for one third of Spain's olive oil production, and there are also vineyards, fruit orchards, cereals, esparto grass, vegetables, and tobacco. Another activity of some importance is stock raising, including the breeding of fine horses. Jaén's industries consist chiefly in processing her mineral and agricultural products. The capital of the province is Jaén (q.v.), other important cities are Úbeda, La Carolina, and Andújar. Pop. (1950) 765,697.

JAEN, city, Spain, located about 40 miles north of Granada and 50 miles west of Córdoba. Capital of the Province of Jaén (q.v.), the city is picturesquely situated on a wooded mountain slope, rising in terraces high above the valley of the Guadalbullón River, a tributary of the Guadalquivir. It is a trade center for the products of the region, especially olive oil. In addition, Jaén has liquor distilleries, tanneries, and manufactures of iron oxide, fertilizers, colored tiles, hemp rope, furniture, hats, and flour products. Limestone and gypsum are quarried nearby. The city lies on a branch railroad connecting with Córdoba and other important centers.

Jaén was founded by the Romans. In the 8th century A.D. it was conquered by the Moors, under whose rule it was the capital of a small principality. Ferdinand III of Castile took the city in 1246. It still retains its narrow, winding streets, the remains of Moorish walls, and the ruined Moorish citadel dominating it. Jaén's large Renaissance cathedral was built during the 16th to 18th centuries. Pop. (1950) 61,610.

JAFFA, jāf'ā (ancient JOPPA; Arab. YAFA), town, Israel, combined in 1950 with Tel Aviv (q.v.), which it adjoins to the south. It is situated in the Plain of Sharon, on the Mediterranean Sea, 34 miles northwest of Jerusalem, whose port it was from ancient times. Jaffa, which appears in history as early as the reign (1490-1436 B.C.) of Thutmose III of Egypt, was taken by the Israelites under King David in the early 10th century B.C. and retaken by Simon Maccabaeus (after 142 B.C.) when the Greek domination ended. It is famous in the Old Testament as the place where Jonah (1:3) embarked on his fateful voyage, and in the New Testament as the place where Peter raised Dorcas from the dead (Acts 9:36-43) and had his vision concerning the clean and the unclean (10:1 ff.).

Jaffa was captured by the Crusaders in 1126 and changed hands several times until it finally fell to the Saracens 70 years later. Eventually it passed to the Turks, who lost it to the British in 1917. Thereafter it was included in the Brit-

ish mandate of Palestine until taken by the Israelis during their struggle for independence in 1948. Most of the previously large Arab population of Jaffa was resettled elsewhere thereafter.

JAFFNA, jăf'nâ, town, Ceylon, situated near the northern tip of the island on the southwest coast of Jaffna Peninsula, on Jaffna Lagoon, 240 miles north of Colombo by road and railway. It is the capital of the Northern Province and the Jaffna District and also a small port and market place for grain, tobacco, coconut, palmyra fiber, and mangoes. Turtles, chank shells, and trepangs are taken in the local waters. Jaffna Peninsula is a low limestone plain, intensively cultivated with rice and other crops. The climate is hot and the rainfall is low, but despite these handicaps it is Ceylon's most heavily populated area with the exception of the Colombo area.

The region of Jaffna was settled by Tamils from India before the beginning of the Christian era. In 1544 Roman Catholic missionaries came here; in 1617 the town was captured by the Portuguese and in 1658 by the Dutch. The town was occupied by the British in 1795 during their conquest of Ceylon. Pop. (1953) 77,218.

JAGANNATH or **JUGGERNAUT**. See **PURI**.

JAGATAI, jăg-â-tî', or **CHAGATAI**, chăg-â-tî', Mongol ruler; d. 1242. The second son of Genghis Khan (q.v.), he commanded armies for his father. In 1227, by his father's will, he received territory in central Asia roughly corresponding to the region of Turkestan, but in 1229 he recognized his younger brother Ögödei as the khan, his father's successor, and served as his adviser. Among his descendants was Tamerlane.

JAGELLON, yă-gěl'ün, name of the second Polish dynasty, founded in 1386 with the marriage of Queen Jadwiga (r. 1384-1399), daughter of Louis I of Hungary and Poland, with Jagello, grand duke of Lithuania, who ruled Poland as Ladislas II or V (r. 1386-1434). The successors of Jagello were Ladislas III or VI (r. 1434-1444), Casimir IV (r. 1447-1492), John Albert (John I, r. 1492-1501), Alexander (r. 1501-1506), Sigismund I (r. 1506-1548), and Sigismund II (r. 1548-1572), who was the last of the direct line. Catherine, sister of Sigismund II and wife of John III of Sweden, was the mother of Sigismund III, King of Poland (r. 1587-1632), who was succeeded by his sons, Ladislas IV or VII (r. 1632-1648) and John II Casimir (Casimir V, r. 1648-1668).

During the reign of the Jagellon dynasty Poland, in combination with Lithuania, became a great power. Owing chiefly to the efforts of Jagello (Ladislas II) and his son, Casimir IV, the power of the Teutonic Knights was broken, West Prussia being taken from them by the Second Peace of Thorn (1466), while East Prussia remained only as a fief of the Polish crown. The period also produced a golden age for Polish culture and intellectual activity. Jagellon prestige was such that the son of Casimir IV was elected king of Bohemia as Ladislas II (r. 1471-1516) and of Hungary (r. 1490-1516). His son, Louis II (r. 1516-1526) was the last Jagellon in Hungary and Bohemia. See **BOHEMIA—History**; **HUNGARY—History**; **POLAND—History**.

JAGERNDORF. See **KRNOV**.

JAGERSFONTEIN, yă'kërs-fôn-tân', town, Union of South Africa, located in the Orange Free State 70 miles southwest of Bloemfontein. It is the site of an important diamond mine, the first diamond having been discovered in 1878. Among the famous diamonds found here were the Excelsior in 1893, a stone of 971 carats, and in 1895 the Jubilee, a flawless white stone of 634 carats. The mine was closed in 1932 due to depressed world economic conditions, but it was reopened in 1949. Gold has also been discovered nearby. Pop. (1951) 5,164; with adjacent mine compound, 7,051.

JAGGARD, jăg'êrd, William, English printer; b. about 1568; d. 1623. He printed various unauthorized editions of William Shakespeare's poems, the first of which was *The Passionate Pilgrime* (1599), although many of the poems were actually by others. Appointed about 1610 as printer to the city of London, he became blind shortly thereafter, but this misfortune did not deter him from success. He continued to pirate Shakespeare's work with an edition of the plays (1619), containing some which were not by Shakespeare. However, he is known chiefly as the publisher of the first folio edition of Shakespeare, *Mr. William Shakespeares Comedies, Histories, & Tragedies*, which appeared in 1623 after Jaggard's death. Eighteen of the plays appeared for the first time in this publication, and important textual corrections were made in those which had been published in earlier (quarto) editions.

Consult Willoughby, Edwin E., *The Printing of the First Folio of Shakespeare*, Supplement to the Bibliographical Society's Transactions, No. 8 (London 1932); id., *A Printer of Shakespeare* (London 1934).

JAGUAR, jăg'wâr or jăg'û-âr (*Felis onca*), the largest cat of the New World, distinguished by its grayish or tawny coat characteristically spotted with black. It ranges from north of the Mexican boundary, in Texas, New Mexico, and Arizona, southward through Mexico and Central and South America as far as northern Argentina where the pampas begin. The common Latin American name for the beast is *tigre* (tiger). The term jaguar is a corruption of the Indian *yaguar* or *yaguareté*.

A fully developed male may attain a combined head and body length of 6 feet, a tail length of 2½ feet, and weigh up to 400 pounds. As compared with the puma (q.v.), which nearly equals it in size, the jaguar is robuster and more heavily built, especially around the forequarters, and its head is proportionately larger. The ground color of the body, ranging from grayish to tawny, is marked with a pattern of spots and irregular stripes. The spots of the head and fore and hind limbs are solid and arranged individually; those of the body are grouped to form rosettes, each enclosing a dark patch that may be dotted with one or two small spots. The chest and throat are whitish and marked with irregularly traced transverse stripes, the belly is blotched, the tail is banded with broad stripes terminally and with blotches toward the base. The ears on the inner side are white; on the outer, black with a whitish or yellow spot.

The jaguar is the largest, most powerful, and most feared carnivorous animal of Latin America. Except for man, it has no enemies, and before

the introduction of firearms even man did not always command the respect of the cat. Nevertheless, jaguars rarely attack man unprovoked and almost never become man-eaters, as do individual lions, tigers, and leopards. The abundance of peccaries and capybaras—and the ease with which these animals can be killed—keeps the jaguar well fed during most of its natural life. Deer, tapir, and crocodiles are also preferred prey, but any animal regardless of size may be eaten by a hungry *tigre*. Older jaguars, no longer agile enough to make easy kills of elusive wild game, may attack domestic stock, especially pigs. In villages where there are no firearms or other weapons which the jaguar has learned to fear, it shows its contempt for man by entering huts and carrying off dogs and even children and old people. The jaguar is nearly as strong as the lion or tiger and can drag a horse or a cow over rough terrain for great distances to a secluded place where the victim can be devoured without disturbance. It takes readily to water and swims easily, even with a tapir or cow clasped between its jaws. It fishes by reclining along the edge of a stream or lake, swiftly striking and hooking with its claws any passing fish or turtle. It is said that the jaguar taps the surface of the water with its tail to lure fish within striking distance.

Jaguars are generally nocturnal, but may be active during the day, especially during the breeding period. They climb well, but older or heavier cats remain on the ground unless treed by dogs trained especially for hunting them. They breed once a year, but, evidently, during no particular season. The period of gestation varies from 13 to 15 weeks, the longer time being taken by females in captivity. Two to four cubs are produced at a birth and they are generally weaned and set adrift at an early age. Adult stature is acquired at 3 years of age and an individual jaguar may live for 20 years.

PHILIP HERSHKOVITZ,
Chicago Natural History Museum.

JAGUARUNDI, jä-gwà-rün'dī, or **YA-GUARUNDI** (also called EYRA), a small American wildcat slightly larger than a domestic cat and characterized by an unspotted coat and narrow face. The jaguarundi (*Felis jagouarundi*) owes both its common and scientific names to a Gallic corruption of the original Guarani Indian term *yaguarundis*. The species ranges from the Mexican border in the United States southward into northern Argentina. Individual jaguarundis appear in either a dark gray color phase or a reddish color phase. This dichromatism has misled some into believing that each color phase represents a distinct species. The jaguarundi has a keener appetite for birds than for any other kind of game. It is remarkably astute in raiding hen houses and, seemingly, can sense exactly when and where to make the attack without being detected by man until it is too late. The cat never kills more than it can eat and steals one hen daily until the henery has been depleted. The jaguarundi is active during the day and, apparently, less given to climbing than are its spotted relatives. See also CAT.

PHILIP HERSHKOVITZ,
Chicago Natural History Museum.

JAHANGIR, jä-hän'gēr, or **JEHANGIR**, emperor of Hindustan: r. 1605–1627; b. 1567; d.

October 1627. Fourth emperor of the Mogul dynasty, he succeeded his father, Akbar (q.v.) the Great, in 1605. Named Selim, after his accession he took the title of Jahangir (Conqueror of the World). He was a weak and tyrannical ruler, who was able to maintain his father's empire and to suppress the rebellion of his son, Prince Khusru, but could not add to the empire. Jahangir was the first Mogul to receive a trade mission from Great Britain. His strong-willed empress, Nur Jahan, gradually secured the reins of government, while Jahangir indulged his taste for art, literature, and drink.

See also INDIA—17. History: 6th Century B.C.—1707.

JAHN, yän, Friedrich Ludwig, German patriot and gymnastic director: b. Lanz, Germany, Aug. 11, 1778; d. Freyburg an der Unstrut, Oct. 15, 1852. After studying theology and philology at Halle, Göttingen, and Greifswald, in 1809 he became a teacher at Berlin. In 1811, with the purpose of strengthening German youth and consolidating national resistance to Napoleonic rule, he opened in Berlin the first Turnplatz, or outdoor gymnasium, and from this developed a gymnastic association (Turnverein) throughout Germany. Jahn himself is often called the *Turnvater* (Father of Gymnastics). Jahn's young gymnasts volunteered for the army in large numbers. After the defeat of Napoleon in 1815, Jahn was appointed state teacher of gymnastics and, as such, he was influential in the Burschenschaft (q.v.) movement. However, his liberal political views resulted in the closing of the Turnplatz and Jahn's imprisonment (1819–1825) by the reactionary Prussian government, and, even when released, he was forbidden to live within 10 miles of Berlin. After the revolution of 1848 he was elected a member of the general German parliament at Frankfurt am Main, which attempted in the years 1848–1849 to create a government for a united Germany. Features of Jahn's gymnastic training have persisted in more recent German nationalist movements, including that of National Socialism. See also GYMNASTICS, HISTORY OF; PHYSICAL EDUCATION—Modern Revival (Germany and Slavic Countries).

JAHN, Otto, German classical philologist, archaeologist, and musicologist: b. Kiel, Germany, June 16, 1813; d. Göttingen, Sept. 9, 1869. He was professor of archaeology at the universities of Greifswald (from 1842) and Leipzig (from 1847), but was dismissed from the Leipzig post because of his activities in the German revolution of 1848. From 1853 to 1867 he served as professor of classical philology and archaeology at Bonn. Although called to a chair in Berlin in 1867, he was prevented by poor health from entering upon his new duties.

Jahn was a many-sided scholar, a prolific writer on classical philology, music, and classical archaeology. In archaeology he laid stress on exact and scientific method, in opposition to the symbolical school of interpretation represented by such archaeologists as Eduard Gerhard (1795–1867). He prepared many editions of classical authors, including *Juvenal* (1851) and *Florus* (1852). Among his numerous other works are: *W. A. Mozart*, 4 vols. (1856–59); 6th ed., 2 vols. (1923–24); Eng. tr., *Life of Mozart* (1891); *De antiquissimis Minervae simulacris Atticis* (On the Oldest Attic Representations of Minerva, 1866);

Gesammelte Aufsätze über Musik (1866); *Biographische Aufsätze* (1866); *Griechische Bilderchroniken* (1871).

JAI ALAI. See PELOTA.

JAINISM, jī'nīz'm, is one of the many religions of India, followed by only about one million people, mostly in the northwest region. It closely resembles Buddhism, being a reaction contemporary with it in the 6th century B.C., from the precedent Brahmanism. These revolts arose from several causes: (1) the Kshatriya (warrior caste) sought release from the religious domination of the Brahman (priest caste); (2) Kshatriya philosophy rejected the Vedic deities; (3) the doctrine of noninjury. This last item gave to Jainism its outstanding trait. Softened by a tropical climate, humanized by a settled life in place of the old nomadic one, and driven by economy to abandon animal food, Indians had become increasingly reluctant to kill animals, except that the Brahmins naturally still demanded them for sacrifice. This practice was condemned by the Jains, who then proceeded with that extravagance characteristic of every Indian activity to spare all animal life whatsoever, even when noxious. To that end, the Jaina monk is equipped with a broom to sweep insects from his path, and a veil to sift them from his mouth, besides the inevitable almsbowl. Nor may he kill or disturb insects feeding upon his body. Moreover, Jains support beast-hospitals in many cities of western India, where old or lame buffaloes, cows, goats, sheep, fowl, and hordes of vermin are housed and fed.

Jainism was founded in the 6th century B.C., by Nataputta, entitled by his followers Mahavira (Great Hero) and Jina (Conqueror). The son of a chieftain, he led a worldly life until at 30, upon the death of his beloved parents, he was so agitated by the seriousness of life that he left his wife and relatives and wandered naked as a homeless ascetic. For 12 years he practiced the severest austerities with deep meditation, and was never moved to anger, though beaten by sinful men. Thus did he become the Jina (Conqueror) and Kevalin (Perfect Sage).

The Jaina monk attains deliverance for his spirit from the bonds of flesh by following the *triratna* (three jewels): knowledge, faith, and virtue.

This knowledge teaches that the world consists of eternal spirits and eternal atoms, without any supreme being. Eight re-births, after becoming a Jaina monk will secure the spirit's release from matter; not for absorption into the absolute—as Brahmanism taught—nor for annihilation in Nirvana—as Buddhism taught—but for something beyond human speculation; so that the Jaina was termed "the may-be philosopher." Such agnosticism has never flourished among the credulous, imaginative Indians, who, moreover, lack the mental discipline afforded by science. The second jewel is faith which reposes in the word of their master, Mahavira, and the declarations of their scriptures, the Agamas. Virtue, the third jewel, consists of the five-fold conduct that results from such knowledge and such faith, namely: (1) to kill nothing whatever; (2) not to lie; (3) not to steal; (4) to abstain from sexual pleasures; (5) to renounce all the attachments of the senses. "What is discontent and what is pleasure? One should live subject to neither. Giving up all

gaiety, circumspect, restrained, one should lead a religious life. Man! Thou art thine own friend; why lookest thou for a friend beyond thyself?"

Seven sects are classed as Svetambara (white-attire) in contrast with the Digambara (sky-attire) who migrated to the South where a more equable climate allowed them to make compulsory that nakedness which had been only recommended in the earlier texts. These may be the gymnosophists mentioned by Greek historians, but nowadays they merely doff their upper garments during meals. There are other Indian ascetics, however, who still discard clothing, and are generally countenanced.

This monk-regimen was much tempered for the Jains laity, who in fact, were mostly prosperous tradespeople, farming being prohibited by the non-injury doctrine. But, furthermore, this extension of Jainism to include laity introduced two important changes in the religion. First, to meet the religious needs of common folk, a worship of the founder, Jina, was instituted with temples, idols, festivals, and offerings of flowers and incense. Second, the monks were compelled to abandon their homeless wanderings, in order to care for the souls of their resident laity. This, in turn, led to the erection of temples, the most costly and delicately beautiful in all India, as at Mount Abu, and the erection of cloisters where the leisured monks produced a varied literature. Thus does Nature, though expelled with a pitchfork, return in the end. Unlike Buddhists, the Jains maintain caste, some of them being even Brahmins.

EDMUND BUCKLEY.

JAIPUR, jī'pūr, or **JEYPORE**, city, Union of India, capital of the state of Rajasthan, 140 miles west of Agra. It is the only city in India laid out in rectangular blocks. The city contains the palace of the maharaja of the former state of Jaipur, several colleges, and a notable open-air observatory. Manufactures include silk and cotton textiles, pottery, and brass and lacquer work. The city was founded in 1728 by Maharaja Jai Singh II to supplant Amber, 5 miles to the north as capital of the state; the state came under British protection in 1818. Pop. (1941) 175,810.

JAIR, the name of several men mentioned in the Old Testament. The most important of that name judged Israel 22 years. He is said to have had 30 sons who rode on 30 ass colts. Considerable discussion has arisen among commentators because of the attempt made to distinguish the Jair mentioned in the Hexateuch from the Jair of the book of Judges.

JAIRUS, jā'ī-rūs, in the New Testament the name of a certain ruler of a synagogue whose home was not far from Capernaum. He had a daughter 12 years old who became critically ill, lying at the point of death. He sought Jesus in order that he might exercise his healing power. Jesus at once accompanied the anxious father. Before the home was reached, a messenger met them announcing the child's death. When they arrived at the home, Jesus said, "She is not dead but sleepeth." The professional mourners were sent from the room after ridiculing the statement. The parents and three disciples were detained. He then went to the bed, took the child by the hand and pronounced two Aramaic words *Talitha Cumi* or "daughter arise," and "she arose and walked" (Mark 5:22-43; Luke 8:41-56).

JAISALMER, jī'sāl-mēr, town, Union of India, in Rajasthan 140 miles west-northwest of Jodhpur. It was formerly the capital of the Indian state of Jaisalmer. The state, 15,980 square miles in area, lay within the great Indian desert. Lack of rainfall and permanent streams makes agriculture almost impossible, the inhabitants depending mainly on livestock for their sustenance. In 1156 a Rajput ruler built the fort around which grew the town of Jaisalmer. Pop. (1941) 7,120.

JAJCE, yī'tsē, town, Yugoslavia, 62 miles by rail southeast of Sarajevo, occupying a hill overlooking the picturesque Pliva River where it falls 100 feet into the Vrbas River. A series of small lakes and cascades along the course of the Pliva through miniature gorges and tree-clad mountains, with the main fall at Jajce, are utilized for industrial purposes without detracting from the natural scenic beauties of the neighborhood. The "Lake Fort" or Turkish Djöl Hissar, at Jezero, lies five miles west of Jajce. A 14th century fortress crowns Jajce hill. The 15th century church of Saint Luke with a fine Italian campanile is said to cover the traditional grave of the evangelist. In the church are preserved and exhibited the casket and skeleton of the last king of independent Bosnia, Stefan Tomasevic, who was flayed alive by the Turks and beheaded in Kraljeva Polje, the "King's Field" just outside the walls. During the Moslem invasion of Europe in the 15th century, the districts of Jajce and Srebrenica, organized as the banate or kingdom of Bosnia, and garrisoned by Hungarians, fiercely opposed the Turks as the outpost of Christendom. In 1528, two years after the defeat of the Hungarians at Mohacs, Jajce surrendered to the Turks, who held it until the annexation of Bosnia and Herzegovina by Austria in 1908. Pop. (1931) 7,515.

JAKARTA. See DJAKARTA.

JAKOBHAVN, yā-kōps-houn', Danish settlement on the west coast of Greenland, situated on an inlet of Disko Bay. Established in 1741, it was named for Jakob Severin, a leading trader in Greenland. Fishing is the principal means of livelihood for the inhabitants. Pop. 681.

JALAL-AD-DIN or **JELAL AD-DIN**, jā-lā'loōd-dēn', shah of Khwarazm: d. 1231. In 1220 he succeeded his father, Ala-ad-Din Mohammed, who had overrun most of Persia before coming into conflict with the forces of Genghis Khan. Jalal-ad-Din, forced to flee from Persia, sought refuge in India and was brought to battle on the banks of the Indus. Once more defeated there by Genghis Khan, he fled to Delhi and for a time was safe. He regained some portions of his khanate but again the Mongols defeated him, and his life was terminated by assassination.

JALAL-UD-DIN MUHAMMAD. See AKBAR.

JALAL-UD-DIN RUMI, jā-lā'loōd-dēn'-rōō'mē, Persian philosopher: b. Balkh, Khorasan, 1207; d. 1273. His father was a scholar and carefully educated the son, who also was educated at Aleppo and Damascus. In 1231 he was made director of a college at Konieh in Asia Minor. He gradually developed into a mystic. He founded

an order of dervishes in 1247 for whom he wrote a collection of rules entitled *Mathnawi*. The *Divan* is a lyrical collection of great poetic merit. This philosopher was the first to teach the transmigration doctrine.

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JALALABAD or **JELALABAD**, jā-lāl'ā-bād, town, Afghanistan, on the Kabul River 70 miles east of Kabul and 80 miles west of Peshawar. Situated west of the Khyber Pass and commanding the valley of the Kunar northward to Kabul, it is of considerable strategic importance. Baber, the Mogul emperor, chose the site as a defensive point, but it was not until 1560 that the town was built by Akbar, his grandson. During the First Afghan War (1841-1842) Jalalabad was captured by the British, whose troops, under Sir Robert Sale, withstood a determined siege which lasted from November 1841 to April 1842. Pop. (1948) 14,756.

JALAP, the tuberous root of *Exogonium* (*Ipomoea*) *purga*, or the plant bearing those roots, or the powdered drug derived therefrom. *Exogonium purga*, in the morning-glory family, Convolvulaceae, is suggestive of the cultivated morning-glory. It has twining stems—in cultivation grown on poles—alternate, entire, pointed, cordate leaves, and trumpet-shaped, rose-purple flowers, 2 to 3 inches long, with slightly exserted anthers. Some of the roots on the underground stems become enlarged and tuberous, like the related sweet potato. Native of Mexico, the plants grow in mountainous regions at altitudes of five to eight thousand feet, in rich, moist soil, near the city of Jalapa—hence the name jalap. Propagation is often by young roots. The older ones, which yield the drug, are thick, brownish, furrowed, bearing cork and lenticels. They are commonly dried in nets over fires, thus acquiring a smoky odor. They are also sometimes sundried, the resulting root-slices being lighter in color. Jalap has also been grown in cultivation in Jamaica, South America, India, Ceylon, and to some extent in Europe. The roots can be harvested in about three years. It was formerly used more generally than at present, although over 50,000 pounds are annually imported into the United States. The purgative principle is apparently in the resinous material of the root. It is glycosidic in nature, and has been designated as convolvulin and/or jalapin. It is sometimes considered a mixture, although there is disagreement concerning its components. Insects feeding on jalap seem to avoid the resinous material, and as a result the "worm-eaten" remains are more potent than the original. A number of other plants in the morning-glory family and their roots are also called jalap; some have properties similar to those of jalap in varying degrees. Among them are: Tampico jalap, *Ipomoea simulans* (Mexico); male or Orizaba jalap, also called Mexican scammony—not true scammony—*Ipomoea orizabensis* (Mexico); wild jalap, *Ipomoea pandurata* (United States and Canada); Indian jalap or turpeth root, *Ipomoea turpethum* (India, Malaya and Australia); and Brazilian jalap, *Piptostegia pisonis*.

EDWIN B. MATZKE.

JALAPA, hā-lā'pā (older **XALAPA**; in full **JALAPA ENRÍQUEZ**), city, Mexico; capital of the

State of Veracruz. It is situated at an altitude of some 4,500 feet on the southern slope of Macuil-tépetl, one of the mountains of the Sierra Madre Oriental. The city attracts numerous persons because the climate is both warmer in winter than the cities of the lofty central plateau and cooler in summer than the port of Veracruz on the coast. The streets, generally cobbled, are narrow and winding because the city has been built upon broken ground. It is constructed in the Spanish style and has many fine plazas filled with brilliantly colored flowers. Jalapa was a sizable Indian town, and its situation on the main route between Mexico City and Veracruz gave it a continued importance after the Spanish conquest. It is the center of an agricultural region which is particularly known for its coffee, tobacco, and fruit wines. There is a large cigar industry in the city, and there are cotton mills and tanneries. Pop. 66,509.

JALISCO, hä-lës'kô, state, Mexico, on the central Pacific coast. The Sierra Madre Occidental, known locally as the Sierra de Jalisco, separates the state in two parts: a narrow tropical zone which follows the coast and a more moderate and far greater plateau area to the east. The southeastern region is volcanic, the Volcano of Colima, 12,792 feet high, is along the border between Jalisco and the State of Colima. Cereals are the chief agricultural products of the uplands; cotton, sugarcane, rice, and tobacco are grown near the coast. Silver, gold, cinnabar, and bismuth are the chief mineral products. The most famous products of the state are its pottery and its tequila. The latter, an alcoholic beverage made from the juice of the maguey cactus, is produced largely in the town of Tequila, 40 miles northwest of Guadalajara, the state capital. The beautiful Lake of Chapala, the largest lake in Mexico, from which a delicious white fish is obtained, is located in the east along the State of Michoacán border. Guadalajara is a focal point for railroads and highways which run inland from Mexico's Pacific coast and thence toward Mexico City. The state has an area of 31,149 square miles. Pop. (1960) 2,443,261.

JALOUSIES. See WINDOW.

JALOUX, zhà-lōō, Edmond, French novelist, essayist, and critic: b. Marseille, France, June 19, 1878; d. Lausanne, Switzerland, August 22, 1949. His abundant and well-received work earned for him membership in the French Academy in 1936. *Soleils disparus* (1927), *La grenade mordue* (1933), and *Le dernier jour de la création* (1935) are among his best-known works of fiction. Jaloux loved to portray, in a Parisian setting or in the décor of his native Provence, the evolution of delicate sentiments and moderate passions in an atmosphere of peaceful and elegant melancholy. His literary ideal is better fulfilled in reverie, in symbolism, and even in the fantastic, than in the concrete presentation of life. His work appears, in retrospect, as a faithful reflection of the humanism, mild pessimism, and escapist tendencies of the Third Republic bourgeoisie, for whom he was writing. As a critic, Edmond Jaloux was served both by his creative experience and by his wide culture. Among his favorite writers were the English novelists and the German romantics, whom he appreciated for their antirealistic tendencies. Typical essays are collected in *L'esprit des*

livres (1923-1940) and *Les saisons littéraires* (1942; 1950).

RENÉ GIRARD,
The Johns Hopkins University.

JALUIT, hăl'ōo-it, atoll, Marshall Islands, a part of the Ralik Chain in the western Pacific Ocean. (See MARSHALL ISLANDS.) The atoll is about 30 miles long and 12 miles in breadth. There are 84 islets. At Jabor, an inlet on the southeast side of the atoll, is a safe harbor.

JAM, jām, cooked fruit suspended in a jelly (see JELLY). Except for berries, which are used whole, the fruits are cut into pieces and boiled with sugar until the juice is jellylike. *Marmalade* is chopped oranges or other fruits suspended in their syrup, essentially a jam. *Conserve* is a very thick jam, usually with nuts added. *Fruit butter* or *fruit honey* is much the same as a jelly, but it is cooked to a paste and strained through a colander. *Preserves* have a thicker concentration of fruit than jam, in a thinner syrup. All of these products are used as a spread for breads and as a filling for pastries. Some jams and jellies, notably currant, are used as an accompaniment for roasted meats and even as a glaze for meats such as ham and venison.

Commercial jams and jellies are made with added pectin, a colorless and apparently amorphous colloid of plant origin. Its microscopic threads, swollen by the hot syrup, cause the jam to set. Fully ripe fruit becomes low in natural pectin and needs the addition of the commercial product to jell. Underripe fruit frequently needs very little added pectin. The manufacturer's instructions may be followed for home-produced jam. The addition of pectin increases the quantity of jam because juices do not have to be reduced drastically, and a clearer, more natural color results from shorter cooking time. Some fruits are naturally high in pectin. The apple family, which includes quince, jells easily; so do grapes, blackberries, and currants. Strawberries and raspberries require added pectin because they are usually made into jam after they have ripened and achieved their full color.

Jam is more successful if made in small quantities from fruit which is cut up into bite-size pieces, or smaller as in the case of marmalades. A little water added to the kettle with the sugar and fruit prevents sticking. The mixture should cook only until the fruit is tender, not until all color drains out, especially in the case of berries. It should be stirred only enough to dissolve the sugar or to avoid sticking and scorching. When the fruit reaches boiling point, it should boil rapidly in order to preserve color and flavor.

In general, four cups of prepared fruit and three cups of sugar will yield about two pints of jam. If the jam is prepared without pectin, cooking time may be determined by the jelly test—inserting a cool spoon to see whether the juice will clot. A thermometer will register 220° F at the jelly stage. Boiling time is from 8 to 20 minutes, depending on the fruit, its tenderness, and its pectin content if commercial pectin is not used. Jars should be hot and sterilized when the mixture is poured. It is best to seal the jars while they are hot in order to avoid mold and then to store them in a dry place.

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Stoppelman-Plix

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MARGARET WORTHINGTON GOSSETT,
Author of "Now You're Cookin'" and "Children's
Picture Cook Book."

JAMAICA, jā-mā'kā, island in the Antilles and an independent nation since Aug. 6, 1962. This former British colony is situated in the Caribbean Sea between north latitudes 17°43' and 18°32', between west longitudes 76°11' and 78°21', about 90 miles south of Cuba. Its central position in the Caribbean and the Greater Antilles places it in the direct sea lane between the Panama Canal and the ports of Europe and the eastern United States. The island's greatest length is 146 miles from west to east; the width varies from 22 to 51 miles. Its area is 4,411 square miles. The Cayman Islands and Turks and Caicos Islands, former Jamaican dependencies, became separate units of The West Indies federation in 1959, and were placed under control of the British Colonial Office after May 31, 1962, when the federation was dissolved.

The population of Jamaica is 1,648,000 (1963), with Negroes predominating. English is spoken throughout the island. Kingston, the capital, largest city, and chief seaport, is situated in the southeast; with Port Royal and St. Andrew, it has a population of 377,412 (1959). Other important localities are Spanish Town, the capital until 1870, and the north coast ports of Montego Bay, Port Antonio, and Ocho Rios, centers of resort areas with fine beaches and excellent hotels. Mandeville is one of many mountain resorts on the island, and there are thermal springs with accommodations for visitors at Bath and Milk River.

The Land.—Jamaica is mountainous, rising to 7,402 feet at Blue Mountain Peak, in the eastern portion of the mountain chain that runs the length of the island. The Cockpit Country, in the west, is an unusual series of irregular, jagged ridges, with little earth. They are formed into circular arenas like inverted cones, varying from 30 to 200 feet in diameter and terminating in most instances with sinkholes at the bottom. The coastal plains, mainly in the south, are composed of alluvial sands, gravels, and loams, abutting the limestone hills. Jamaica's many rivers and springs gave the island its name, "Xaymaca," meaning "isle of springs" in the language of the aboriginal

Arawak Indians. The island's caves are remarkable for their beauty and grandeur.

One of the most attractive features of Jamaica is its climate. Temperatures vary between 80° and 86° F on the coast, from 68° to 75° F at 3,000 feet, and as low as 40° to 50° F at the highest mountain resorts. The heaviest rainfall, exceeding 200 inches annually, occurs near the Blue Mountains in the northeast, but the annual average for the island is about 77 inches. The rainy months are May and October, although in the northeast rains also fall between November and January. Hurricanes occur on the average of once in seven years. Hurricanes and earthquakes have inflicted disasters on the island several times during its history. The destruction of Port Royal by an earthquake in 1692 led to the founding of Kingston, which also was damaged severely by an earthquake in 1907, with a loss of 800 lives.

Flora and Fauna.—Centipedes, scorpions, harmless snakes, and many species of lizards, including the large iguana, are found in Jamaica. Insects include mosquitoes, ants, fireflies, and beetles. There are over 20 kinds of songbirds, as well as parrots, pigeons, and waterfowl. Many varieties of North American birds winter on the island. The rivers contain a few species of edible fish, but the coastal waters have so far proved relatively poor in seafoods. Common trees include the pimento (allspice) in abundance, ceiba, mango, wild orange, plantain, fustic, logwood, cedar, coconut, and other palms; but the royal palm, common to the Antilles, is absent. The southern coast exhibits flora of the arid-climate type, including cacti and thorny acacias. Begonias, orchids, ferns, and grasses abound elsewhere on the island.



Map of the island of Jamaica in the Caribbean Sea.

Economy.—In recent years, the economy of Jamaica, formerly dependent on the export of sugar and bananas, has shown a striking trend toward expansion and diversification. The government has successfully encouraged the growth of manufacturing and food production for the local market, and two relatively new industries—mining and tourism—are now major contributors to the economy. The increasing importance of the tourist trade has fostered the development of a construction industry, which is particularly active around Kingston and in the Ocho Rios region on the north coast. Trebling of the gross national product since 1950 is significant evidence of Jamaica's eco-

In recent years, since visitors have discovered Jamaica's ideal climate, tourism has become a major industry.

Herbert Lanks-Pix



nomic progress, much of which may be traced to the development of light industry.

Jamaica contains the world's largest known resources of commercial bauxite (over 500 million tons), as well as barites, ceramic clays, cobalt, copper, gypsum, lead, limestone, marble, oil, cave phosphates, silica, and zinc.

Agriculture.—More than a third of the total land area, amounting to over 1,000,000 acres, is in agricultural use, including meadow and pasture. An additional 500,000 acres are in woods and forests. Sugar is the main export crop, 60 percent of the cane being produced on estates and the remainder on farms. The total acreage actually in cane was 174,990 in 1959. Over 100,000 acres are devoted to bananas, and 47,000 acres are under citrus cultivation. Other products include pimiento, coffee, annatto, cacao, coconuts, rice, tobacco, fruits, vegetables, and livestock. The major agricultural exports are handled by marketing organizations.

Industry.—The government encourages industry both by the Industrial Development Corporation, a statutory body set up in 1952 with offices in New York and London, and by incentive legislation passed in 1956: the Pioneer Industries (Encouragement) Law, the Industrial Incentives Law, and the Export Industry (Encouragement) Law. The Corporation is developing an industrial estate in Kingston, and the incentive program has been responsible for the introduction of many new industries. In addition to cement manufacture (stimulated by the growth of tourism), the production of rum and molasses, the reduction of bauxite to alumina, and the processing of agricultural products, there are many light industries. In 1958 manufacturing replaced agriculture as the principal contributor to the gross domestic product.

Jamaica is the world's largest exporter of bauxite, which is mined by one Canadian company and three American firms. Exports rose from 2,529,363 dry tons in 1955 to 4,147,555 dry tons in 1960. The Canadian company reduces bauxite to alumina on the island, and alumina exports rose from 183,969 tons in 1955 to 665,361 tons in 1960, a 67 percent increase over 1959. Gypsum is also mined, and prospecting for iron ore and copper is taking place.

The tourist industry plays an increasingly important part in the Jamaican economy. In 1960, 226,000 tourists visited the island, compared with 61,831 in 1948. The value of the industry was estimated at £11.8 million.

Transportation.—Jamaica has 2,668 miles of main roads, and 2,137 miles of secondary roads

suitable to light motor traffic. There are 249 miles of railroad. Two international airports serve the island, one at Palisadoes, near Kingston, the other at Montego Bay. Eleven scheduled airlines and many shipping lines call at the island.

Education.—The Jamaican government has endeavored to make primary education available to all children, and secondary education to those pupils who demonstrate ability. In the fiscal year 1960 it spent £5.3 million on education, compared with £0.8 million in fiscal year 1948. There were 741 primary schools in 1963, with an enrollment of 305,000, and 45 secondary schools, with 18,270 pupils. There were also five teacher-training colleges, six vocational schools, and a college of arts, science, and technology. The latter institution is the University of the West Indies, which was established in 1949 at Mona, St. Andrew, and became an autonomous body in 1962. It annually enrolls about 700 students. Each year more than 3,000 other Jamaicans attend universities, colleges, and training hospitals in Great Britain, the United States, and Canada.

Government.—Jamaica is a constitutional monarchy and an independent dominion within the Commonwealth of Nations. The island formed an internally self-governing territory within the federation of The West Indies from July 4, 1959, to May 31, 1962, when the federation was officially dissolved. The new constitution which went into effect commensurate with independence on Aug. 6, 1962, provides for a governor general who is appointed by the British sovereign; a privy council of six members appointed by the governor general; a cabinet consisting of a prime minister and at least 11 other ministers; and a bicameral legislature. There is a House of Representatives comprising 45 members who are elected one to each constituency by universal adult suffrage for five-year terms. The Senate has 21 members, of whom 13 are appointed by the governor general on the advice of the prime minister, and the remaining eight on the advice of the leader of the opposition.

The prime minister must be able to command a majority in the House of Representatives, and members of the cabinet are appointed on his advice. Not more than three or less than two cabinet ministers must be members of the Senate, and the remainder are chosen from the House of Representatives.

The governor general acts on the advice of the prime minister and cabinet except when the matter is the responsibility of some other body. He is advised by the privy council on the exercise of his



Military barracks on Newcastle Hill overlook Jamaica's verdant hills.

Camera Press-Pix

disciplinary power over the civil service and on his use of the royal prerogative of mercy.

History.—Jamaica was discovered on May 3, 1494, by Christopher Columbus, and it remained a Spanish colony from the appointment of the first governor in 1509 until its capture by the English, under Adm. William Penn, in 1655. The Spaniards exterminated the original Arawak Indian inhabitants and introduced Negro slaves. When the English conquered Jamaica, many of these slaves escaped into the interior, forming the nucleus of a mountain people called Maroons, who developed a distinctive culture and fought for their independence for over a century. A Jamaican constitution came into effect in 1662, establishing a governor, a nominated council, and an elected House of Assembly. British sovereignty was recognized by the Treaty of Madrid in 1670, and government under the 1662 constitution continued until the 19th century.

After the English conquest, Jamaica grew rich and prosperous from raids conducted on Spanish shipping by the buccaneers, who made the island their headquarters. Large-scale importation of slaves began, and Jamaica became a thriving marketplace for this trade. The island reached the height of its prosperity around 1800, exporting large quantities of sugar and coffee.

Severe economic difficulties during the first half of the 19th century ruined the planters and created social unrest among the impoverished Negroes. Abolition of the slave trade in 1807 and emancipation from 1833 to 1838 increased the planters' production costs, and the withdrawal of British tariff protection for colonial products in 1846 completed their economic downfall. Taxation, inequities in land distribution, lack of political representation, and the importation of East Indian labor aggravated the resentment of the Negroes toward the whites. This hostility culminated in an unsuccessful rebellion at Morant Bay in 1865.

The establishment of British colonial government the next year ushered in a period of political, economic, and social reform. The new governor, Sir John Peter Grant, reorganized the judicial and financial structures, improved education and medical services, and introduced the cultivation of bananas, which became one of Jamaica's staple crops. From 1866 to 1944 the governor was advised by a privy council and a legislative council, both at first composed of official and nominated members. An elected element was introduced into the council in 1884 and gradually extended over the next 60 years.

The Constitution of 1944 gave Jamaica a wide measure of internal self-government, including

universal suffrage. In 1953 ministerial government and an elected majority in the executive council were introduced, and in 1957 the beginnings of cabinet government were established when a council of ministers replaced the executive council. The 1959 constitution established full internal self-government within the federation of The West Indies, which Jamaica had joined at its inception on Jan. 3, 1958. In 1961 the United States returned to the Jamaican government the bases on the island it had leased from Great Britain during World War II, and retained navigational facilities on the island for 17 years.

Although Jamaica comprised more than half of The West Indies federation's total land area and population, it was represented by a minority in the federal legislature, and many Jamaicans believed they would be dominated in an independent federation by the smaller and less prosperous members. In a referendum of Sept. 19, 1961, they elected by a vote of 251,935 to 216,400 to withdraw from the federation. Representatives of Jamaica and Great Britain subsequently agreed to provisions for the island's independence outside the federation. In general elections held on April 10, 1962, the electorate turned out the ruling People's National Party of Prime Minister Norman W. Manley in favor of the Jamaican Labour Party headed by Sir Alexander Bustamante. Jamaica was the first of the British West Indies dependencies to attain full sovereignty when the island became independent on Aug. 6, 1962.

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JAMAICA, former village, New York, and a part of the Borough of Queens in New York City since Jan. 1, 1898. Formerly it was the seat of Queens County, Long Island. It is now an industrial and residential center in the southeastern area of the city, a subway terminus, and a junction on the Long Island Rail Road. In 1657 Governor Peter Stuyvesant gave permission for its settlement and in 1660 granted a charter. The original name of Rustdorp was soon changed to Jamaica, a word derived from the local Jameco Indian tribe. Important among the

several well-preserved pre-Revolutionary houses is King's Mansion which once belonged to Rufus King, a signer of the Constitution and an early minister to England.

JAMAICA BAY, bay, New York, is an inlet of the Atlantic Ocean which indents the southwest corner of Long Island in the boroughs of Brooklyn and Queens in New York City. Elliptical in shape and slightly less than 20 square miles in area, it contains many marshy islands. It is separated from the ocean for nearly its whole extent by the peninsula of Rockaway Beach. Coney Island is near the entrance channel. Floyd Bennett Field is located on the southwest shore while the New York International Airport is situated on the northwest shore.

JAMAICA NUTMEG. See CALABASH NUTMEG.

JAMAICA PLUM. See SPONDIAS.

JAMDINA or **JAMDENA**, yām-dā'nā, island, Indonesia, largest of the Tanimbar group, in the Moluccas 300 miles southeast of Ambon (Amboina). It is 70 miles long and 28 miles wide, the area being 1,100 square miles. Saumlakki, the chief village, is at the southern end of the island.

JAMES, Saint (often known as **SAINT JAMES THE GREATER**), the son of Zebedee. He was called to be an apostle together with his brother St. John, as they were mending their nets with their father Zebedee, who was a fisherman. They then followed Christ, were witnesses with St. Peter of the transfiguration, and accompanied Christ in the garden of Gethsemane. In the lists of the apostles given in the synoptic Gospels and in the Acts the names of Peter, Andrew, James and John stand first; and it is plain that these four were at the head of the 12 throughout. After the ascension St. James persevered in prayer with the other apostles and the women and the Lord's brethren. Nothing further is certainly known of him until the Passover of 44, when, being in Jerusalem, the Jews stirred up Herod Agrippa I against him, and he was put to a cruel death. Thus St. James was the first of the apostles who suffered martyrdom. There is a legend that he went to Spain, and that his bones, said to be in the foundation of the Cathedral of Santiago-de-Compostella in Coruña, lent miraculous aid to the Spaniards against the Saracens.

JAMES, Saint (called **THE LESS**), an apostle, was the son of Alphaeus. Little is known of him, though legend has it that he was active in Palestine and Egypt and finally was crucified in Lower Egypt.

JAMES (called **THE JUST**), a brother or cousin of Jesus, became head of the Christian religious community of Jerusalem. At first skeptical of Jesus, he later became a convert after being favored by an appearance of the risen Christ. Free from strictly legalistic views, he nevertheless felt that Gentile Christians ought to respect observances of laws by Jewish Christians. The Epistle of James is generally ascribed to him.

JAMES I, king of England and, as James

VI, also of Scotland: b. Edinburgh, June 19, 1566; d. Theobalds, Hertfordshire, March 27, 1625. He was the son of Mary, Queen of Scots, and Henry, Lord Darnley, and great-great-grandson of Henry VII of England. With the forced abdication of his mother in 1567 he was proclaimed king of Scotland, and during his minority the country was governed by a succession of regents—the earls of Moray, Lennox, Mar, and Morton. During most of this period he was under the tuition of the notable George Buchanan. From the first he seems to have imbibed those exalted notions of the royal authority and divine right which proved so injurious to his posterity. But James soon found it advisable to ally himself with Queen Elizabeth and to accept a pension from her. When, however, it became apparent that the life of his mother was in danger from the sentence of an English judicature, James sent representatives to England to intercede with Elizabeth; but his whole procedure in the matter shows a singular callousness. As a matter of form he ordered the clergy to pray for his mother, but when the news of Mary's execution in 1587 arrived James was not much moved, though he attempted to make a show of indignation by condemning one of the commissioners to death, a sentence which, however, he commuted to banishment. On Nov. 23, 1589 James married Anne, daughter of Frederick II, king of Denmark. On his return home, after passing the winter in festivities at Copenhagen, he was in some danger from the unruliness of the nobles; and for several succeeding years of his reign the history of Scotland displays much turbulence and party contest, but the supremacy of the crown was finally vindicated. In 1603 James succeeded to the crown of England, on the death of Elizabeth, and proceeded amidst the acclamations of his new subjects to London. One of his first acts was to bestow a profusion of honors and titles on the inhabitants of both countries. At a conference held at Hampton Court between the divines of the Established Church and the Puritans, James exhibited the ill will he bore to popular schemes of church government. The meeting of Parliament also enabled him to assert those principles of absolute power in the crown which he could never practically maintain, but the theoretical claim of which provided the increasing spirit of freedom in the House of Commons with constant matter of alarm and contention. Although James had behaved with great lenity to the Catholics in Scotland, those in England were so disappointed in their expectations of favor that the famous gunpowder plot was concerted in 1605, the object of which was to blow up the king and Parliament. (See **GUNPOWDER PLOT**; **GREAT BRITAIN AND NORTHERN IRELAND** —21. *History* (Early Stuarts and Commonwealth)).

In 1612 he lost his eldest son Henry, a prince of great promise, then 19; and in the following year the eventful marriage of his daughter Elizabeth with the Elector Palatine took place. No circumstance in the reign of James was more unpopular than his treatment of the celebrated Sir Walter Raleigh (q.v.). James had set his heart on marrying his son Charles to a Spanish princess, but the negotiations failed through the overbearing temper of Buckingham (George Villiers), the royal favorite, who quarreled with the grandees of the Spanish court. The close of the life of James was marked by

violent contests with Parliament and by a breach with Spain after the negotiations for Prince Charles' marriage had failed. His reign saw the beginnings of English colonization in America with the founding of Jamestown in 1607, and the completion of a new translation of the Bible (1611), called in his honor the King James version. His numerous literary works include 15 sonnets published in Edinburgh in 1584 under the title *Essays of a Prentice in the Divine Art of Poesy*; a translation of the Psalms of David; *Basilikon Doron* (1599); and a treatise, *Daemonologie* (1599). His famous *Counterblaste to Tobacco* was first published anonymously in 1604. An edition of his prose works, including Biblical commentaries, was published in London in 1616 by James Montagu, bishop of Winchester. The political works were reprinted in 1928.

Consult Henderson, T. F., *James I and VI* (London 1904); Davies, Godfrey, *The Early Stuarts* (New York 1937); Sisson, C. J., *James I as Poet and Political Writer* (Oxford 1938).

JAMES II, king of England: b. London, England, Oct. 14, 1633; d. St. Germain, France, Sept. 6, 1701. The third son of Charles I and Henrietta Maria, daughter of Henry IV of France, the first born having lived but two hours. Created duke of York and Albany (1643), James fled England during the Civil War and spent 12 years abroad, serving with distinction in the French and Spanish armies. Returning to England with his elder brother, Charles II, at the Restoration (1660), he was appointed lord high admiral and also made warden of the Cinque Ports. The diary of Samuel Pepys, secretary of the navy, attests the great interest which James showed in improving the organization of the fleet, including the creation of a permanent body of naval officers. In 1664 an English squadron surprised and seized the Dutch province of New Netherlands, in America, for which the duke had been granted a secret royal patent. New Amsterdam and Fort Orange were renamed New York and Albany in his honor. He commanded the fleet in a naval victory over the Dutch in 1665 and in a drawn battle against them at Southwold Bay in 1672, but the Test Act, barring Catholics from public office, cost him his naval post in 1673.

In September 1660 he had married Anne Hyde, daughter of Edward, afterwards 1st earl of Clarendon. Before her death in 1671 she became a Roman Catholic, an event which led to the public avowal by James in 1672 of his own conversion to that faith. On September 30 of the next year he married a Catholic princess, Mary Beatrix of Este, daughter of the duke of Modena, thus definitely aligning himself with the policies of Louis XIV; but at the insistence of Charles II he assented to the marriage in 1677 of his eldest daughter Mary to the Protestant prince, William of Orange.

After a few months' retirement (1679) on the Continent during the national ferment over the Popish Plot, James served as high commissioner in Scotland (1679–1682), and in 1684 regained his former post at the Admiralty. The efforts of Parliament to prevent his succession failed; and at the death of Charles II in 1685, James came to the throne. He showed from the first his determination to restore the power of the Roman Catholic Church and to make himself an absolute monarch. Rebellions led by the duke of Argyll in Scotland and by the duke of Monmouth in England (1685) were suppressed; but the savage

reprisals known as the Bloody Assizes, conducted by the lord chief justice George Jeffreys, alienated much of James' following even among the Tories. His overthrow was hastened by the resistance of seven of the English bishops to his demand that they read from their pulpits a declaration of indulgence, exempting Catholics and dissenters alike from penal statutes. Indicted for petitioning against the order, the bishops were acquitted amid popular rejoicing on June 30, 1688, and on that day a large body of Whig nobility and gentry concurred in inviting William of Orange to occupy the English throne. With a fleet bringing a force of 14,000 men, William arrived at Torbay, Devon, on November 5; several of James' leaders at once deserted and the royal army followed by whole regiments. James was apprehended in flight and brought back to London, but later was allowed to escape and reached France, where he was hospitably received by Louis XIV and given the château of St. Germain as a refuge. Meanwhile, William and Mary were proclaimed joint sovereigns of England (Feb. 13, 1689), and Anne, sister of Mary, was declared next in succession, to the exclusion of her infant brother James Stuart, known as the Old Pretender. In France James did not desist from efforts to regain the throne. He landed in Ireland on March 12, 1689, but was completely defeated by the king's armies at the Battle of the Boyne, July 1, 1690, and returned to France, where he spent his remaining years.

Consult Belloc, Hilaire, *James the Second* (Philadelphia 1928); Turner, F. C., *James II* (New York 1948).

JAMES or JAMES EDWARD, prince of Wales, known also as **JAMES III** and the **OLD PRETENDER**. See **STUART, JAMES FRANCIS EDWARD**.

JAMES I, king of Scotland: b. Dunfermline, Scotland, July 1394; d. Perth, Feb. 21, 1437. He was the third son of Robert III, second of the Stuart kings. To remove him from danger following the murder of his elder brother David, duke of Rothesay, King Robert ordered him to France in 1406. He was captured by English sailors on the journey, however, and detained by Henry IV and Henry V for the next 18 years in England, where he was given a good education and treated by Henry V as a guest. Just before his release he married Jane (or Joan) Beaufort, daughter of the earl of Somerset, and in her praise wrote *The Kingis Quair*, an allegorical poem in the style of Chaucer, discovered in the Bodleian Library at Oxford in 1783. Several other poems, including *The Ballad of Guid Counsall*, *Christis Kirk on the Greene*, and *Pebblis to the Play*, have been attributed to him, with doubtful authenticity.

James was crowned king of Scotland at Scone on May 21, 1424. During his 13 years of rule he did much to curtail the arbitrary power of the feudal lords and to establish government by law in the kingdom, with the aid of Parliament. The resulting enmity of the nobles led to his assassination by Sir Robert Graham at the instigation of Walter Stewart, earl of Atholl, James' uncle. The legend of the heroic effort by Catherine Douglas (nicknamed "Bar-lass"), one of the queen's attendants, to bar the door to the assassins with her arm, arose out of this incident.

Consult Balfour-Melville, Evan W. M., *James I, King of Scots* (London 1936).

JAMES II, king of Scotland: b. Oct. 16, 1430; d. Roxburgh, Scotland, Aug. 3, 1460. Son of James I, he was crowned at Holyrood in his seventh year, while Archibald, 5th earl of Douglas, was named regent. In 1449 James married Mary of Gelderland, and assumed power in his own name, bringing to an end the struggle which had persisted during his minority between the house of Douglas and the factions of Sir Alexander Livingstone and Sir William Crichton. When the Douglasses continued to assert their independent power, James murdered William, the 8th earl, with his own hand at Stirling Castle in 1452. Having further secured his reign by suppressing an insurrection by the next earl, whose lands he confiscated, James attacked English forces in the south of Scotland, and was killed by a wedge from a cannon while besieging Roxburgh Castle.

JAMES III, king of Scotland: b. July 10, 1451; d. near Bannockburn, Scotland, June 11, 1488. The eldest son of James II, he was crowned at Kelso in 1460. During his minority Scotland remained under the authority of the Boyds of Kilmarnock, one of whom married the king's sister Mary in 1467. Two years later James himself was married to Princess Margaret of Denmark and assumed the government. He was opposed in his policy of reducing the power of the nobles by his brothers Alexander, duke of Albany, and John, earl of Mar. Mar was murdered in 1479, but Albany escaped and, seeking support in England, was recognized by Edward IV in 1482 as king of Scotland. With Richard, duke of Gloucester (later Richard III), he invaded Scotland, taking Berwick and marching on Edinburgh, where he and James were temporarily reconciled. Two years later, after again conspiring against the king, Albany fled to France. The rebellious nobles then made the king's son James head of their party, and finally routed the royal army at Sauchieburn, near Bannockburn, on June 11, 1488. The king was murdered nearby later the same day.

JAMES IV, king of Scotland: b. March 17, 1473; d. Flodden, England, Sept. 9, 1513. He was crowned at Scone in 1488 soon after the assassination of his father James III, for his share in which James IV is said to have worn an iron belt as penance. Under his rule Scotland advanced materially and rose in political importance. In 1503 he was married to Margaret, daughter of Henry VII, from whom the Stuarts derived their title to the English throne a century later. With Henry VIII, his brother-in-law, however, he was unable to remain at peace. After making a treaty of alliance with Louis XII of France in 1512, James gathered a large army, invaded England, and was defeated and killed at Flodden, along with a large number of Scottish nobles.

JAMES V, king of Scotland: b. Linlithgow, Scotland, April 10, 1512; d. Falkland, Dec. 14, 1542. He succeeded to the throne as an infant after his father, James IV, was killed at the Battle of Flodden (1513), and began to govern in his own right in 1528. He married Princess Madeleine of France at Paris in 1537, and on her death espoused Mary, daughter of the duke of Guise, in 1538. When his uncle, Henry VIII of England, invaded Scotland in 1542, James was

deserted by the Protestant nobles and suffered defeat at the Battle of Solway Moss. He died the next month, several days after the birth of his daughter Mary, Queen of Scots. Noted for his efforts to protect the poor from oppression, he was often called the "king of the commons."

JAMES VI, king of Scotland. See **JAMES I**, king of England.

JAMES, Edmund Janes, American educator and author: b. Jacksonville, Ill., May 21, 1855; d. Covina, Calif., June 17, 1925. He was educated at Northwestern and Harvard universities, and at the University of Halle in Germany. After serving as principal of an Illinois high school for several years, he was appointed (1883) professor of public finance and administration at the Wharton School of Finance and Commerce at the University of Pennsylvania. He was a founder in 1885 of the American Economic Association, and a leader also in the formation of the American Academy of Political and Social Science, becoming the academy's first president (1890-1901) and the first editor of its *Annals* (1890-1896). After serving at the University of Chicago as professor of public administration (1896-1901), he was president of Northwestern University (1902-1904), and of the University of Illinois from the latter date until 1920. In this position he secured greatly increased legislative appropriations for the university and raised its standards of scholarship. He was the author of *The Canal and the Railway* (1890); *The Education of Business Men in Europe* (1899); *The Growth of Great Cities in Area and Population* (1900); *A National Economic Program* (1916).

JAMES, Frank Cyril, British economist and educator: b. London, England, Oct. 8, 1903. He graduated from the University of London in 1923 and three years later received a Ph.D. from the University of Pennsylvania. He began teaching at the Wharton School of Finance and Commerce there in 1924, and in 1935 was made chairman of the Graduate Faculty in Social Sciences. Three years later he was invited to join the faculty of McGill University in Montreal, Canada, and became its principal and vice chancellor in 1940. He is the author of *The Economics of Money, Credit and Banking* (1930; 3d ed., 1940) and *The Growth of the Chicago Banks* (2 vols., 1938).

JAMES, George Payne Rainsford, English novelist and historian: b. London, England, Aug. 9, 1799; d. Venice, Italy, June 9, 1860. Inspired by the novels of Sir Walter Scott, he began at an early age to write biographies and historical romances, becoming widely known with the appearance of *Richelieu* (1829), which Scott commended. During the next 30 years he published more than 100 popular novels, whose style William Makepeace Thackeray parodied in his *Novels by Eminent Hands*. His historical works include *Memoirs of Great Commanders* (1832); *Life of Edward, the Black Prince* (1836); *Life of Richard Coeur-de-Lion* (1842-1849); and *A History of Chivalry* (1843). Under William IV he held the office of historiographer royal (1839), in this capacity writing a *History of the United States Boundary Question* and *The Corn Laws*. In 1850 he was appointed British consul at Boston, Mass., and served in the same capacity at

Richmond, Va., from 1852 to 1856, when he was made consul at Venice.

JAMES, George Wharton, American explorer: b. Gainsborough, Lincolnshire, England, Sept. 27, 1858; d. St. Helena, Calif., Nov. 8, 1923. Having come to the United States in 1881, he was pastor of Methodist churches in California and Nevada, and afterwards devoted himself to travel in the Southwest and the study of Indian cultures. He lectured extensively and wrote more than 40 books describing these regions and their Indian life, including *In and Around the Grand Canyon* (1900); *In and Out of the Old Missions of California* (1905); *Prehistoric Cliff Dwellings of the Southwest* (1913); *Indian Blankets and Their Makers* (1914).

JAMES, Henry, American ethical and religious philosopher: b. Albany, N. Y., June 3, 1811; d. Cambridge, Mass., Dec. 18, 1882. He was the father of Henry James (1843-1916) and William James (1842-1910) (qq.v.). Having graduated from Union College, Schenectady, N. Y., in 1830, he entered Princeton Theological Seminary in 1835 to prepare for the Presbyterian ministry, but soon found himself unable to accept the tenets of any organized church. In 1844, while in England, he found in the writings of Emanuel Swedenborg the approach he had been seeking, and devoted himself from this time on to expounding his own adaptations of Swedenborgian thought. In social philosophy he was an adherent of Fourierism and the Brook Farm school, whose leaders he came to know intimately. Among his books are *Moralism and Christianity* (1850); *The Nature of Evil* (1855); *Christianity the Logic of Creation* (1857); *Substance and Shadow* (1863); *The Secret of Swedenborg* (1869); and *Society the Redeemed Form of Man* (1879). His *Literary Remains*, edited by William James, were published in Boston in 1885.

Consult Grattan, Clinton H., *The Three Jameses: A Family of Minds* (New York 1932); Warren, Austin, *The Elder Henry James* (New York 1934); Matthiessen, Francis O., *The James Family* (New York 1947).

JAMES, Henry, American novelist and critic: b. New York, N. Y., April 15, 1843; d. London, England, Feb. 28, 1916. He was the son of Henry James (1811-1882, q.v.) and brother of the philosopher William James (1842-1910, q.v.). Under his father's guidance, he received much of his early education in Geneva, London, Paris, and Boulogne, where his family resided in 1855-1858 and 1859-1860. Returning to the United States, he entered Harvard Law School in 1862 and while still at Cambridge was encouraged by William Dean Howells, editor of the *Atlantic Monthly*, to follow a literary career. From about 1865 he devoted himself to writing, contributing to the *Nation* and the *Galaxy* as well as to the *Atlantic*. In the latter his first novel, *Watch and Ward*, was serialized (1871). Meanwhile, in 1869 he had visited Europe again, and after 1872 maintained virtually permanent residence there, settling in England in 1876 and becoming a British subject in 1915. A month before his death in 1916 he received the Order of Merit.

Working at first in London, and from 1896 in Rye, Sussex, James produced novels, stories, and literary criticism which have won ever-increasing critical acclaim. While his fiction deals almost exclusively with the wealthy and well-

born in English and expatriate American society, and has been further criticized for the labyrinthine complexity of its style, his superb craftsmanship sustains his reputation as a novelist's novelist. *Roderick Hudson* (1876) was followed by some 20 major works, notably *The American* (1877), of which a dramatized version was produced in London in 1891; *The Europeans* (1878); *Daisy Miller* (1879), his first considerable success; *The Portrait of a Lady* (1881); *Washington Square* (1881), dramatized in 1948 as *The Heiress* and made into a motion picture; *Princess Casamassima* (1886); *The Bostonians* (1886); *The Tragic Muse* (1890); *The Spoils of Poynton* (1897); *What Maisie Knew* (1897); *The Awkward Age* (1899); *The Sacred Fount* (1901); *The Wings of the Dove* (1902); *The Ambassadors* (1903); and *The Golden Bowl* (1904). Two novels unfinished at his death, *The Ivory Tower* and *The Sense of the Past*, were published in 1917.

Besides these he wrote a large number of stories, of which many take rank with his major works and have appeared, variously combined, in numerous editions, beginning with *A Passionate Pilgrim and Other Tales* (1875). Other such collections include *The Madonna of the Future and Other Tales* (1897); *Tales of Three Cities* (1884); *The Aspern Papers*, Louisa Pallant, and the Modern Warning (1888); *The Reverberator* (1888); *The Wheel of Time* (1893); *The Real Thing and Other Tales* (1893); *Embarrassments* (1896); *The Two Magics* (1898), containing *The Turn of the Screw*, a ghost story of subtle horror, dramatized by William Archibald and produced at The Playhouse, New York, Feb. 1, 1950; and *The Finer Grain* (1910). In literary criticism he is best known for his *French Poets and Novelists* (1878); *Partial Portraits* (1888); *Essays in London and Elsewhere* (1893); *Picture and Text* (1893); *The Question of Our Speech, and the Lesson of Balzac* (1905); *Notes on Novelists* (1914). Books describing his travels include *Transatlantic Sketches* (1875); *Portraits of Places* (1883); *A Little Tour in France* (1885); *English Hours* (1905); *The American Scene* (1907), resulting from a visit to the United States—his first in 20 years; and *Italian Hours* (1909). He wrote biographies of Nathaniel Hawthorne (1879) and William Wetmore Story (1903) and two volumes of autobiography, *A Small Boy and Others* (1913) and *Notes of a Son and Brother* (1914). A collected edition, *The Novels and Tales of Henry James*, was published in New York (26 vols., 1907-1917) and with additions, in London (35 vols., 1921-1923). See also *AMBASSADORS, THE; AMERICAN, THE; AMERICAN LITERATURE—The Elusive Spirit of Life: Henry James; BOSTONIANS, THE; DAISY MILLER*.

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JAMES, Henry, American writer, lawyer, and administrator: b. Boston, Mass., 1879; d. New York, N. Y., Dec. 13, 1947. He was the son of the philosopher William James (1842-1910,

q.v.). After graduating from Harvard University, he practiced law in Boston (1904-1912), and then was business manager until 1917 of the Rockefeller Institute for Medical Research in New York. He also served as chairman of the board of the Teachers Insurance and Annuity Association from 1934 until his death. He edited a two-volume collection, *The Letters of William James* (1920), and was author of two notable biographies, *Richard Olney* (1923) and *Charles W. Eliot* (1930), which latter received the Pulitzer Prize.

JAMES, Jesse (Woodson), American outlaw: b. near Kearney (then Centerville), Clay County, Mo., Sept. 5, 1847; d. St. Joseph, Mo., April 3, 1882. His family were originally Kentuckians and openly supported the Southern cause in the Civil War. Before he had reached 16 years of age he had gained a reputation for marksmanship and daring while serving with Confederate guerrilla forces led by William Clarke Quantrill. At the close of the war he surrendered, but on his return home was declared an outlaw through the influence of hostile neighbors. In 1866 he was joined by his brother FRANK JAMES (in full ALEXANDER FRANKLIN JAMES: b. Jan. 10, 1843; d. Feb. 18, 1915), Coleman Younger, and others, in forming an armed band which during the next 16 years was responsible for a long series of train and bank robberies and murders in Midwestern states. A reward of \$10,000 being offered by Governor Thomas T. Crittenden of Missouri for the taking of the James brothers, two of his own gang, Charles and Robert Ford, turned traitor and shot and killed him in his home at St. Joseph, Mo., where he was living under the name of Thomas Howard. Later Frank James surrendered but was never convicted, and spent his remaining years on a farm near Excelsior Springs, Mo. In his lifetime Jesse James was admired by many for the epic style of his exploits. Afterwards legends grew about him; he was the hero of more than 400 dime novels, a popular ballad, and a mural painted by Thomas Hart Benton in the state capital at Jefferson City, Mo.

Consult James, Jesse E., *Jesse James, My Father* (Independence, Mo., 1899); Love, Robertus, *The Rise and Fall of Jesse James* (New York 1926); Breihan, Carl W., *The Complete and Authentic Life of Jesse James* (New York 1953).

JAMES, John Angell, English Congregational clergyman: b. Blandford, Dorsetshire, England, June 6, 1785; d. Birmingham, Oct. 1, 1859. Before he was 20 he became pastor of Carr's Lane Chapel in Birmingham, serving there for more than 50 years and becoming one of the most noted preachers of his time. His works, with autobiography, were published in 17 volumes (1860-1864).

JAMES, Marquis, American journalist and author: b. Springfield, Mo., Aug. 29, 1891; d. Rye, N. Y., Nov. 19, 1955. He began his career as a reporter on Midwestern newspapers, served in France in World War I, and afterwards was national director of publicity for the American Legion. His history of that organization was published in 1923. He was twice awarded the Pulitzer Prize, for *The Raven, a Biography of Sam Houston* (1929), and for *Andrew Jackson: Portrait of a President* (1937), a sequel to his earlier book, *Andrew Jackson:*

The Border Captain (1933). *The Cherokee Strip* (1945) is an autobiography.

JAMES, Montague Rhodes, British bibliographer, Biblical scholar, and author: b. Goodnestone, Kent, England, Aug. 1, 1862; d. Eton, June 12, 1936. He was provost of King's College, Cambridge (1905-1918), and of Eton College until his death. His scholarly works included critical studies of Biblical texts; treatises on psalters and other medieval remains; and catalogues of library manuscripts. He was an authority on stained glass and other religious art, and as M. R. James was widely known for his fantastic stories, unique in their blending of erudition and horror, among which were *Ghost Stories of an Antiquary* (1905); *More Ghost Stories* (1911); and *A Thin Ghost and Others* (1919).

JAMES, Philip, American composer and conductor: b. Jersey City, N. J., May 17, 1890. He was educated in New York, where he studied with Rubin Goldmark and others, and during World War I was bandmaster of the General Headquarters Band of the American Expeditionary Force. In 1923 he joined the faculty of New York University, and 10 years later became chairman of the music department there. He was conductor of the New Jersey Symphony Orchestra (1922-1929) and the Bamberger Little Symphony Orchestra (1929-1936). Among his compositions are three Bret Harte overtures (1926, 1933, 1935); *General William Booth Enters into Heaven* (1932), a cantata; two suites for strings (1933, 1946); and two symphonies (1943, 1949).

JAMES, Thomas, American pioneer: b. Maryland, 1782; d. Monroe City, Ill., December 1847. In 1809 he accompanied Manuel Lisa's furtrading expedition up the Missouri River as far as Fort Mandan; and in 1821, with John McKnight, led one of the earliest trading expeditions through the Comanche country to Santa Fé, arriving just after Mexico had secured its independence from Spain. He returned in 1824 to Illinois, where he served two terms in the state legislature (1825-1828). He published *Three Years Among the Indians and Mexicans* (1846), which was reprinted by the Missouri Historical Society in 1916.

JAMES, Thomas, English navigator: b. about 1593; d. ?1635. In 1631 he was chosen by the merchants of Bristol to lead an expedition in search of the Northwest passage to the Indies and so to circle the globe. With a crew of 22 he set out in May of that year in a small ship, the *Henrietta Maria*, reached Greenland a month later, and then was forced south into Hudson Bay. He discovered and named Cape Henrietta Maria, and also was the first to sail on James Bay, which was later named after him. Unable to reach the mainland, he spent the winter on a small island in the bay, and returned to England in October 1632. His *Strange and Dangerous Voyage of Captain Thomas James* (1633) is one of the most interesting early English books of exploration.

JAMES, Thomas Lemuel, American public official: b. Utica, N. Y., March 29, 1831; d. New York, N. Y., Sept. 11, 1916. He began his career as a newspaper publisher in Utica and Hamilton,

N. Y., became a customs inspector in the port of New York in 1861, and rose to the rank of deputy collector in 1870. Three years later he was appointed postmaster of New York, serving until 1881 when President James A. Garfield appointed him postmaster general of the United States. During ten months in that office he succeeded in ending the Star Route frauds, turned the department's deficit into a surplus, and reduced letter postage from three to two cents.

JAMES, Thomas Potts, American botanist: b. Radnor, Pa., Sept. 1, 1803; d. Feb. 22, 1882. He entered the wholesale drug business in Philadelphia in 1831 and taught at the Philadelphia College of Pharmacy for many years, retiring to Cambridge, Mass., in 1866. Meanwhile he had contributed a series of valuable papers on North American mosses to various scientific publications. After 1878, with Charles Leo Lesquereux, he began the preparation of the *Manual of North American Mosses* (1884), which was completed after his death.

JAMES, Will (full name WILLIAM RODERICK JAMES), American writer and illustrator: b. near Great Falls, Mont., June 6, 1892; d. Hollywood, Calif., Sept. 3, 1942. Born in a covered wagon and soon left an orphan, he was adopted by a fur trapper and taught by him to write. From the age of 13 he was employed on Western and Canadian horse and cattle ranges, and as a performer in rodeos. He had started drawing at an early age, and in 1920 finally decided to give up cowpunching and seek a career as a writer and artist, illustrating his own books. *Cowboys, North and South* appeared in 1924, followed the next year by *The Drifting Cowboy*. *Smoky* (1926) received the John Newbery Medal for the best children's book of the year, and later was made into a motion picture. Others of his works are *Lone Cowboy* (1930), an autobiography; *Scorpion* (1936); *Cowboy in the Making* (1937); and *Flint-Spears* (1938). Stories and articles which he contributed to leading magazines were collected in *Sun-up* (1931) and *All in the Day's Riding* (1932).

JAMES, William, American psychologist and philosopher: b. New York, N. Y., Jan. 11, 1842; d. Chocorua, N. H., Aug. 26, 1910. He was the son of Henry James (1811-1882, q.v.) and brother of Henry James (1843-1916, q.v.). His education, begun in New York private schools, was continued under his father's guidance in France, England, and Switzerland. In Paris he studied art, and on returning to the United States at the age of 18 became a pupil of the Boston artist William Morris Hunt. Making little progress in painting, he entered Harvard University in 1861, studying for three years in the Lawrence Scientific School and then enrolling in the medical school. As assistant to Louis Agassiz, he accompanied the university's zoological research expedition to Brazil in 1865, and on returning continued his studies at Harvard medical school, taking his degree in 1869 after studying for 18 months in Germany under Hermann L. F. Helmholtz and other leading scientists. Because of failing health he was unable to practice medicine, and in 1872 began instead his long association with the faculty of Harvard as an instructor in physiology, anatomy, and hygiene. From 1875 his lectures dealt increasingly with the relation

between physiology and psychology, and in 1876, when appointed assistant professor of physiology, he brought about the establishment of the first laboratory for psychological research in the United States. He was assistant professor (1880-1885) and professor (1885-1889) of philosophy, and professor of psychology from the latter date until 1897 when he was again named professor of philosophy, serving until his retirement in 1907. Already well known for his contributions to American and European scientific journals, James published his first book, *The Principles of Psychology*, in 1890. His work did much to establish psychology as an independent science and, abridged as *Psychology: Briefer Course* (1892), remained for many years the most popular American textbook on the subject. He was concerned for some years after with religion and its bearing on human experience. In 1897 he published *The Will to Believe and Other Essays in Popular Philosophy*, followed by *Talks to Teachers in Psychology and to Students on Life's Ideals* (1898) and *Human Immortality* (1899). His Gifford Lectures at Edinburgh University in 1901 and 1902 were published as *The Varieties of Religious Experience* (1902), one of his most significant works. From this time his published works were almost all in the field of philosophy.

James' lectures at the Lowell Institute in 1906 and others given at Columbia University the next year formed the basis of *Pragmatism: A New Name for Some Old Ways of Thinking* (1907), with which he took rank as the foremost American philosopher of his time, and throughout the English-speaking world was recognized as the brilliant exponent of a new approach to the theory of knowledge. Stated briefly, James' theory, whose origin he attributed to Charles S. Peirce (q.v.) and which was further developed by John Dewey (q.v.), was that the meaning of an idea, and hence its truth, consists in its consequences, both sensory and practical-emotional. Thus an idea that "works" in any desired manner is to that extent true.

The objections which this theory immediately called forth were answered by James in *The Meaning of Truth* (1909). The same year saw the publication of *A Pluralistic Universe*, the Hibbert Lectures delivered at Manchester College, Oxford, in 1908, setting forth his metaphysics, which was admittedly inspired by the French philosopher Henri Bergson.

James' essay, *The Moral Equivalent of War*, appeared in *International Conciliation* (February 1910). *Memories and Studies* (1911), *Some Problems of Philosophy* (1911), and *Essays in Radical Empiricism* (1912) were published posthumously. He was a founder of the American Society for Psychical Research (1884) and maintained throughout his life an interest in psychical phenomena for their value as psychological data if not as proof of human survival after death.

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JAMES, William, English naval historian: d. London, England, May 28, 1827. An attorney in the admiralty court at Jamaica, B.W.I., from

1801, he was interned in the United States when the war of 1812 began, but escaped and reached Halifax, Nova Scotia. A number of letters on the conduct of the war, which he wrote to the *Naval Chronicle* over the signature "Boxer," gained him a reputation as a student of naval affairs, and his fame was extended with the publication in 1816 of *An Inquiry into the Merits of the Principal Naval Actions Between Great Britain and the United States*, which belittled American victories in the late war and was bitterly attacked in the United States for this reason. His major work was *The Naval History of Great Britain from . . . 1793 to the Accession of George IV* (5 vols., 1822-24; 2d ed., 6 vols., 1826), an exhaustive but one-sidedly pro-British account of the events of the period.

JAMES, Epistle of, the first of the seven "Catholic" (general) Epistles in the New Testament, which in ancient Bibles often followed the Book of Acts (as attributed to members of the original group of apostles) but later were shifted to follow the Epistles of Paul (including Hebrews). This led to the view that these were the earliest of the New Testament Epistles, and some writers still assume that James must be the first of all. Its Jewish background, discursive style, and strong moral tone support this view. Some scholars have argued that the Epistle was originally a Jewish work, perhaps a homily, taken over and Christianized in the apostolic age or soon after. But the author makes no claim to be an apostle; he is simply "James [Jacob], a servant of God and of the Lord Jesus Christ." He writes "To the twelve tribes in the dispersion";¹ but this may be either a Jewish or an early Christian phrase (compare 1 Peter 1:1-2; Galatians 3:29; 6:16; Philippians 3:3). Further, Jewish homilies were not as a rule ethical expositions in the style of James, but expositions of Scripture. The author of this epistle was familiar with the Septuagint (q.v.), and also with some of the terms of Greek popular philosophy; his chosen literary form is that of the Stoic-Cynic "diatribe" or ethical discourse delivered on the street corners in the 1st and 2d centuries. He uses many contrasts (for example, the double meaning of *peirasmos* as both trial and temptation; 1:2-18). He castigates the "double-minded" (1:5-8) who cannot let go his reliance on earthly advantages and trust God alone, and also the rich who oppress the poor (5:1-6), and the obsequious who fawn upon the well to do (2:1-7). The subject matter of the little treatise resembles that of the Sermon on the Mount in Matthew (chaps. 5 to 7). It also resembles the *Didache* (q.v.) and other early Christian writings with a strong ethical emphasis.

It has often been supposed that the author had in mind St. Paul's teaching when (2:14-26) he condemned "faith without works" as "dead," and insisted, "Show me your faith apart from your works, and I by my works will show you my faith." (Martin Luther described James as "an epistle of straw"!) But it is more probable that he had in mind the neglect of religious duty which often went with the overintellectualizing of faith in the Hellenistic age and also was criticized by Paul (for example, 1 Corinthians, chaps. 1 to 4), but which in time tended to seize upon Paul's doctrine of "justification by faith" in support of its own attitude and outlook. Religion

which exhausts itself in discussion and debate or in evolving a superior "wisdom" is not "true religion" (1:26-27). Whatever its date (probably late in the 1st century) and authorship, the epistle provides strong evidence that ethics was fully as important as theology in the early Christian church.

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JAMES BAY, inlet, Canada, the southernmost arm of Hudson Bay, named in honor of Capt. Thomas James, an English navigator, who explored it in 1631-1632. The bay is about 275 miles long and 135 miles wide. It contains a number of islands, the largest, Akimiski, being about 60 miles in length. Several large rivers flow into James Bay. The largest of these are the Moose, which is the estuary of the Abitibi, Mattagami, Missinaibi, and other rivers; and the Albany, Nottaway, and Eastmain rivers. Moose Factory, at the mouth of the Moose River, on the southern shore adjacent to Moosonee, is the most important Canadian trading station, next to York Factory, of the Hudson's Bay Company.

JAMES ISLAND, island, South Carolina, one of the Sea Islands, forming part of the southwest side of Charleston Harbor. It is about nine miles long, and is famous for its sea-island cotton. James Island is separated from the city of Charleston by the Ashley River and the South Channel of the harbor, here a little over a mile wide. On the northeast coast of the island is Fort Johnson and nearby a former quarantine station. Just northeast of the island is Fort Sumter (q.v.). The Battle of Secessionville (see SECESSIONVILLE, BATTLE OF), fought on June 16, 1862, and several other engagements of the Civil War, took place on this island.

JAMES OF COMPOSTELA, SAINT. See JAMES, SAINT (the Greater).

JAMES RIVER (known also as DAKOTA RIVER), river, North and South Dakota, with headwaters near the southern end of Devils Lake in central North Dakota. It flows southeast, following the valleys formed by glaciers, and joins the Missouri River at Yankton, S.Dak. The river, 710 miles long, is not navigable. In its course, it passes the cities of Jamestown, N.Dak., and Huron and Mitchell, S.Dak. Along its banks are remnants of dwellings of the ancient mound builders. Fur-trading posts were located along the river, especially in Brown and Spink counties (S.Dak.) and near the river's mouth. New settlements grew up along the river after 1870.

JAMES RIVER, river, Virginia, one of the largest in the state, formed by the junction of the Jackson and Cowpasture rivers near Iron Gate (Alleghany County) in the Allegheny Mountains, about 15 miles from the West Virginia border. It flows in a winding, easterly course,

¹ Revised Standard Version text used throughout.

about 340 miles, past Buchanan in Botetourt County; northeast through the Blue Ridge Mountains, where a drop in its gorge produces scenic Balcony Falls; southeast to Lynchburg; northeast to Scottsville; then generally southeast past Richmond to Hampton Roads, the broad channel at its mouth, through which it enters Chesapeake Bay. For a distance of about 100 miles from its mouth, the James is a tidal stream, with the head of navigation just below Richmond. In its lower course it receives the Appomattox River from the south at Hopewell, and the Chickahominy from the north near Williamsburg. A 3-mile series of rapids over an 84-foot drop above Richmond is utilized for water power. A bridge (4½ miles long) spans the river above Newport News. The Port of Hampton Roads at the James' mouth is a center for shipbuilding, trade, and numerous federal government activities, including a major naval base. The first permanent English settlement in North America was made on Jamestown Island in the river (1607); it is now the site of historical monuments (see JAMESTOWN, Virginia).

JAMESON, jām's'n, **Anna Brownell** (nee MURPHY), Irish author and art critic: b. Dublin, Ireland, May 17, 1794; d. Ealing, Middlesex, England, March 17, 1860. Her father was a painter of miniatures, who moved to England in 1798 and was attached for a time to the household of Princess Charlotte, daughter of the prince regent. Anna worked as a governess from the age of 16 until her marriage (1825) to Robert Jameson, a barrister, from whom she was separated after four years. He later became a distinguished judge in Canada. Her first literary success was *Diary of an Ennuyée* (1826), based on her travels on the Continent as a governess. A series of other travel books and sketches of famous women followed, the best of which was *Characteristics of Women* . . . (2 vols., 1832), on Shakespeare's heroines. In later years she made a more enduring reputation as a writer on art, beginning with *A Handbook to the Public Galleries of Art in and near London* (2 parts, 1842), a catalogue of the pictures, accompanied by critical, historical, and biographical notes. Her major work was a series of books on religious art, which she illustrated with etchings of famous pictures: *Sacred and Legendary Art* (2 vols., 1848), *Legends of the Monastic Orders* (1850), and *Legends of the Madonna* (1852).

JAMESON, **Horatio Gates**, American surgeon: b. York, Pa., 1778; d. New York, N.Y., Aug. 26, 1855. He studied medicine with his father and began to practice in rural Pennsylvania when he was only 17. After 18 years he took a medical degree at the University of Maryland and established his office in Baltimore, where he became a leading surgeon. Jameson was the first American surgeon to remove a scirrroid tumor of the uterus and one of the first to perform a ligature on the external iliac artery. With Philip Syng Physick, he pioneered in the use of animal ligatures. He played a leading part in public health work in Baltimore and from 1827 to 1851 conducted his own institution, the Washington Medical College, there.

JAMESON, **J(ohn) Franklin**, American historian: b. Somerville, Mass., Sept. 19, 1859; d. Washington, D.C., Sept. 28, 1937. Graduated from Amherst College in 1879 (Ph.D., Johns

Hopkins, 1882), he was professor of history at Brown University (1888-1901) and then at the University of Chicago, which he left to become director (1905-1928) of the Department of Historical Research of the Carnegie Institution in Washington, D.C. In this position Jameson directed an intensive study of federal government archives, which led eventually to the establishment of the National Archives Building and the National Historical Publications Commission. He also organized a wide search of government records in European and other American countries for documents relating to United States history. Among the fruits of this work was the series *Original Narratives of Early American History* (19 vols., 1906-17), of which he was general editor. Jameson was one of the founders of the *American Historical Review* and its managing editor (1895-1901, 1905-1928). As chairman of the Committee of Management, he played a leading part in the publication of the *Dictionary of American Biography* (20 vols., 1928-36). From 1928 until his death he was chief of the Manuscripts Division of the Library of Congress. His books include *The History of Historical Writing in America* (1891) and *The American Revolution Considered as a Social Movement* (1926). He also supervised compilation of the *Census of Medieval and Renaissance Manuscripts in the United States and Canada* (3 vols., 1935-40).

JAMESON, **SIR Leander Starr** (known as DOCTOR JAMESON), South African statesman: b. Edinburgh, Scotland, Feb. 9, 1853; d. London, England, Nov. 26, 1917. After practicing medicine briefly in Edinburgh, he went to South Africa in 1878 and became the close friend and confidant of Cecil Rhodes in Kimberley. Rhodes, who had formed the British South Africa Company as part of his plan to expand British rule north of the Transvaal, sent Jameson in 1889 to negotiate with the Matabele chief Lobengula for goldmining rights in the area. Jameson's tact and medical skill overcame the chief's objections, and Rhodes' expedition set out in 1890. Jameson accompanied it into Mashonaland and in 1891 was appointed administrator of what became the nucleus of Rhodesia. In the Matabele rising of 1893 he accompanied an armed column to Bulawayo, where he remained after the flight of Lobengula and established a British administration over Matabeleland.

By 1895 the internal struggle in the Transvaal between the government of President "Oom Paul" Kruger and the Uitlanders (mainly British settlers) had led to the belief that a rising by the latter was imminent. Jameson, at the head of a small force of British South Africa Company police and volunteers, marched to the border to help his compatriots and, without orders from Rhodes, invaded the Transvaal on Dec. 29, 1895, in what has gone down in history as the Jameson Raid. On Jan. 2, 1896, they were surrounded by the Boers near Doornkop, and compelled to surrender. The British government repudiated Jameson's action. He was brought back to England, tried, and sentenced in 1896 to 15 months' imprisonment, but was released after 4 months on account of illness.

Jameson returned to South Africa in 1899, when the South African War began, and was elected to the Parliament of Cape Colony in 1900. By 1904, following Rhodes' death in 1902, he was the recognized leader of the Progressive Party.

In that year he became prime minister of Cape Colony, holding that office until 1908. His administration was marked by economy, internal reforms and a sincere desire to reconcile the conflicting elements of Boer and Briton. Rhodes' great dream of union in South Africa was unswervingly pursued by Jameson, and it was in a large measure due to his efforts that that ideal was realized in 1909. The policy which he stamped upon the Unionist Party at the Bloemfontein Conference in 1910 has been maintained to the present day. From 1908 to 1912 he sat in the opposition; in the latter year illness compelled him to resign and return to England. He was created a baronet in 1911. In 1913 he was elected president of the British South Africa Company, of which he had been a director since 1902.

Jameson is buried next to Rhodes in the Matopo Hills, near Bulawayo, Southern Rhodesia.

JAMESON, Robert, Scottish mineralogist: b. Leith, July 11, 1774; d. Edinburgh, April 19, 1854. In 1800 he went to Freiberg, Saxony, to study natural history under Abraham Gottlob Werner, and in 1804 was appointed to the professorship of natural history in the University of Edinburgh. In 1809 he published *Elements of Geognosy*, in which he gave a comprehensive exposition of the neptunian theory as modified by Werner. In 1819, with Sir David Brewster, he founded the *Edinburgh Philosophical Journal*, of which he became editor. Others of his principal works are *System of Mineralogy* (1804-1808); *Manual of Minerals and Mountain Rocks* (1821); *Elements of Mineralogy* (1840). He was a fellow of almost all the learned societies of Europe.

JAMESON RAID. See JAMESON, SIR LEANDER STARR.

JAMESONITE, jām'sūn-īt, a sulphide of lead and antimony, $Pb_2Sb_2S_5$. Known as feather ore and a minor source of lead in various mines in Arizona, California, Nevada, South Dakota and Utah. It is named for Robert Jameson (1774-1854).

JAMESTOWN, jāmz'toun, city, New York; in Chautauqua County; altitude 1,315 feet. It is situated at the southern end of Chautauqua Lake, 57 miles south-southwest of Buffalo, and is served by the Erie and the New York Central railroads; it has regular air service. The region surrounding this industrial city is agricultural, with truck and dairy farms, orchards, and vineyards.

Jamestown is one of the leading cities in the United States in the manufacture of furniture. In its early days woodworkers in the settlement made wooden furniture for their pioneer neighbors, and this activity developed into an important industry. Leading manufacturers of metal furniture are also located here. In addition to furniture, both of wood and of metal, Jamestown factories produce filing cabinets and other metal articles of office equipment, voting machines, washing machines, metal doors and window frames, textiles, mattresses, mirrors, kitchen cabinets, and sinks, ball bearings, toys, and automobile parts.

The city has a public library, the James Prendergast Free Library, named after the founder of the town, for whom the city itself was named. It was Prendergast who bought

here 1,000 acres of land, originally purchased by his brother from the Holland Land Company at \$2 an acre. Jamestown has a business college and a community college, a music association, a civic forum, and a Little Theater. The proximity of the famous Chautauqua Institution brings many visitors here annually. Jamestown was the home of Senator Reuben E. Fenton; his memory is honored in a memorial park, in which are his old home and a bronze statue of him.

The first permanent settlement at the outlet of Chautauqua Lake was made about 1806. The site proved attractive and in 1849 Swedish immigrants settled here. After the Civil War others came, most of whom were cabinet makers, drawn here by the furniture industry. The population of Jamestown became largely Swedish. It was incorporated as a village in 1827, and as a city in 1886.

Jamestown is governed by a mayor and council. The water supply system is municipally owned, the water coming from artesian wells. The city also owns and operates the system of generating and distributing current for light and power. Pop. 41,818.

JAMESTOWN, city, North Dakota; seat of Stutsman County; altitude 1,410 feet. It is situated on the Dakota (James) River, 95 miles west of Fargo, and is served by the Northern Pacific and the Midland Continental railroads. There is an airline service. The surrounding region is agricultural, in which wheat growing and the raising of livestock are important activities. The city manufactures flour, cereal foods, and dairy products, and has bottling works. There are a public library, a radio station, two general hospitals, a state hospital for the insane, and the North Dakota School for Crippled Children. The site of Fort William H. Seward, abandoned in 1877, is on the outskirts of Jamestown. The city is the seat of Jamestown College (coeducational), and of a business college. Jamestown was settled in 1871; incorporated in 1896. Government is by mayor and council. Pop. 15,163.

JAMESTOWN, town, St. Helena, South Atlantic Ocean; port and capital of that British island. It was formerly a naval coaling station of great importance, but this activity declined following the opening of the Suez Canal. It has an observatory. Nearby is the tomb in which the body of Napoleon lay until it was transported to Paris in 1840. Pop. (1959) 1,568.

JAMESTOWN, former village, Virginia; in what is now James City County; site of the first permanent English settlement in the United States, and capital of Virginia, 1607-1699. It was founded May 14, 1607 by the Virginia Company of London, on what was then a marshy peninsula (now Jamestown Island) of the James River, about 32 miles from its mouth. The settlement originally consisted of a triangular blockhouse and several huts; these were destroyed by fire in 1608, but soon rebuilt. By 1609 there were some 50 wooden structures, a chapel, and a storehouse, all surrounded by a palisade with a fort at the neck. During the winter of 1609-1610, the settlement was almost wiped out by famine, and the survivors abandoned the site June 7, 1610. Already embarked on ships for the return to England, they met Thomas West, baron De La Warr (Lord Delaware) at the mouth of the James.

De La Warr brought with him supplies and additional colonists; the settlers turned back and reoccupied the village.

By 1619 the colony had attained some degree of stability; tobacco cultivation was introduced, and plantations established to the east and west, along the river. Peaceful relations with the Indians contributed to this period of comparative prosperity. In this year, the first legislative body to meet in the United States convened at Jamestown; 1619 also marked the bringing of the first Negro slaves to Virginia. In the great Indian massacre of 1622, Jamestown suffered less than the surrounding plantations, having been warned before the Indians struck. During Bacon's Rebellion (q.v.) in 1676, the village was again burned and rebuilt; and in the last decade of the century, fire swept it once more. This final disaster, coupled with the removal of the capital to the Middle Plantation (now Williamsburg), in 1699, depopulated the village, and it fell into decay.

The peninsula on which Jamestown was built had become an island by the middle of the 19th century. It was not until 1893, when the Association for the Preservation of Virginia Antiquities began its work, that an effort was made to retrieve what remained of the site. In 1900 the association induced the federal government to build a sea wall to prevent further erosion of the island. About 23 acres on the upper end of the island are owned by the association; the remainder is part of the Colonial National Historical Park, established as the Colonial National Monument, Dec. 30, 1930.

Jamestown is visited by more than 100,000 persons each year. Points of interest on the site include the old church tower, dating from the middle of the 17th century; foundations of the state houses; the Robert Hunt Memorial Shrine, erected in honor of the man who conducted the first Anglican communion in America, in 1607; the statues of Pocahontas and John Smith; and the federal monument, built in 1907, commemorating the 300th anniversary of the founding of the colony, which was the occasion of the Jamestown Tercentennial Exposition, held April 26 to Nov. 30, 1907. Significant work is being done here in the Jamestown Archaeological Laboratory which contains many 17th-century relics unearthed during excavations by the National Forest Service. The colonial park area includes also parts of the city of Williamsburg, the Yorktown Battlefield, and the Cape Henry Memorial at Cape Henry.

JAMESTOWN COLLEGE, Jamestown, N. Dak., a coeducational, liberal arts institution. It was founded in 1883 by the Presbyterian Church and was the first institution in the state to offer normal school training for teachers. The financial panic of 1893 closed its doors temporarily, but it reopened in 1909. There are about 350 students.

JAMI, jā'mī (so called from his birthplace; in Persian *NUR UD-DIN 'ABD-UR-RAHMAN IBN AHMAD*), Persian poet and mystic: b. Jam, Khusasan, 1414; d. Herat, Nov. 9, 1492. He received an excellent education as is evident from his polished style. Jami was the last great classic poet of Persia and was deeply versed in philosophy. In three *Diwans*, appearing from 1479 to 1491, are his odes and lyrical poems. His principal prose work is the *Baharistan* (1847), a col-

lection of short didactic tales. Other works are in the collection *Haft Aurang* (*Seven Thrones*). The *Baharistan* has been translated into English several times. Edward Fitzgerald translated *Salaman wa Absul* from the *Haft Aurang* collection, in 1856, and *Yusuf wa Zalikha*, a version of the story of Joseph and Potiphar's wife, was translated by R. T. H. Griffith in 1882.

JAMIESON, jā'mī-s'n, John, Scottish lexicographer: b. Glasgow, March 3, 1759; d. Edinburgh, July 12, 1838. He was educated at the University of Glasgow and also studied for a short time in Edinburgh. In 1781 he was licensed to preach and became pastor of an Antiburgher congregation at Farfar; in 1797 he accepted a call to the Nicholson Street Antiburgher Church of Edinburgh. Jamieson's reputation as a man of letters rests on his *Etymological Dictionary of the Scottish Language* (1808; supplements in 1825). It is a work of great industry and considerable value as a collection of Scottish words, phrases, and customs, but as first published had little critical or philological merit, according to modern standards. The philological department was greatly strengthened in the edition of 1879-1887 by David Donaldson and John Longmuir. Jamieson also published *Ancient Culdees of Iona* (1811); *Hermes Scythicus, or the Radical Affinities of the Greek and Latin Languages to the Gothic* (1814).

JAMMU, jūm'ōō, town, India; in Kashmir; chief town of the region of the same name. It is situated on the river Tawi, a tributary of the Chanab, 85 miles north-northeast of Lahore. Extensive ruins attest the former splendor of the town. Jammu, which is the winter capital of Kashmir, is the terminus of a railroad linking it with the Indian railroad system. Coal mines are operated in the vicinity. The region of Jammu, formerly an independent kingdom, was conquered in 1820 by Gulab Singh (d. 1857); he joined Kashmir to it in 1846. Pop. (1941; including cantonment) 58,847.

JAMNITZER, yām'nīt-sēr, or **JAMITZER**, yā'mīt-sēr, Wenzel, German goldsmith: b. Vienna, 1508; d. Nürnberg, Dec. 19, 1585. Early in life he went with his family to Nürnberg, and in 1534 was admitted to the guild of master craftsmen. Subsequently he was appointed goldsmith to the court, serving successively the emperors Charles V, Ferdinand I, Maximilian II and Rudolf II. Specimens of his handiwork include a jewel box in the collection of the Dresden Palace, a gilt silver table piece in the Rothschild collection, Paris, statuettes in the treasury of Vienna, a jewel box in the Munich Treasury, and a cup which belonged to William II of Germany.

Wenzel's brother, ALBRECHT, worked with him until 1550. Wenzel's grandson CHRISTOPH (1563-1618) was a designer of ornamental works and an engraver. His *Groteskenbuch* (1610) contains 63 fantastic engravings.

JAMSHEDPUR, jā'm'shēd-pōōr, city, India; in southern Bihar. It is situated at the confluence of the Subarnarekha and Karkhai rivers, 140 miles west of Calcutta. The city was founded in 1909 as the headquarters of the Tata Iron and Steel Company, the largest concern of its kind in India, and was named for Jamsetji Tata, who

first advocated the exploitation of the iron and coal deposits. The center of the Indian iron and steel industry, Jamshedpur has large iron and steel works, railroad shops, and machine factories. Pop. (1941) 148,711.

JAN MAYEN, yān mī'ēn, island, Arctic Ocean, belonging to Norway. It is 360 miles north-northeast of Iceland; area 144 square miles. The island is volcanic, with an irregular surface, mountainous near the extinct volcano, Beerenberg, 8,347 feet high. One of the active volcanoes is about 1,500 feet high. There are some large glaciers on the island, one near Beerenberg. The island was named after Jan Mayen, a Dutch navigator, who visited it in 1611. Later it was ascertained that Henry Hudson had discovered it earlier, in 1607. It was frequently visited later by sealers, whalers, and scientists, and in 1921 a Norwegian observatory was established on the island. On May 8, 1929 Norway annexed Jan Mayen, and that country's sovereignty was subsequently recognized by other powers.

JANACEK, yā'nā-chěk, **Leoš**, Czech composer: b. Hukvaldy, Moravia, July 3, 1854; d. Ostrau, Czechoslovakia, Aug. 12, 1928. In 1865 he became a chorister in the Augustinian monastery at Brno (Brünn), where he studied under the Moravian nationalist composer Paval Křizhovsky. Janáček later studied at Prague, Leipzig, and Vienna. In 1881 he founded the Organ School at Brno, where he taught until 1920, then becoming professor at the conservatory in Prague.

Due to the veneration in which musical circles in his own country held the tradition of Bedřich Smetana (1824-1884), Janáček received little recognition until 1916, when his opera *Její Pastorkyňa* (*Her Foster Daughter*), which had been performed at Brno in 1904, was presented at the Vienna Court Opera in a German version, as *Jenufa*. The melody of his national speech, which he studied in great detail, is the basis of his music, and translations of his vocal works are notoriously difficult due to the intimate relationship of speech tone and melody.

Among his more important other works, with dates of composition are the operas *Sárka* (1887), *Výlety Páně Broučkovy* (*The Exclusions of Mr. Broucek*, 1914), *Kač'a Kabanova* (1919-1921), *Lyška Bystrouška* (*The Cunning Little Vixen*, 1921-1923), *Več Makropulos* (*The Makropulos Affair*, 1923-1924), and *Aus einem Totenhaus* (*From a House of the Dead*, performed 1930); many choral works, including *Zápisn k Zmizeleho* (*The Day-Book of One Who Vanished*, 1916); orchestral works; chamber music; and songs.

JANAUSCHEK, yā'nou-shěk, **Fanny** (in full FRANZISKA MAGDALENA ROMANCE), Bohemian actress: b. Prague, July 20, 1830; d. Amityville, N. Y., Nov. 28, 1904. She first appeared on the stage at Cologne, playing in that city and also in Frankfurt am Main, 1848-1860, and subsequently in Dresden and the principal cities of Germany, becoming a leading tragedienne. She made her first tour of the United States in 1863, playing in the German language and receiving most favorable notices. She later studied English and after 1869 played the most exacting Shakespearean roles in that language. After further tours of Europe and the United States, she made the latter country her home in

1880. Fanny Janauschek was best known for such roles as Lady Macbeth; Medea; Mary, queen of Scots; and Meg Merrilies. Changing styles of drama, however, gradually deprived her of her audiences.

JANE, jān, **Frederick T.**, English naval author: b. Aug. 6, 1870; d. Southsea, Hampshire, March 8, 1916. He was educated at Exeter School, invented the naval war game, and was naval correspondent of the *Engineer*, the *Scientific American*, and the *Daily Chronicle*. A prolific writer on naval affairs, he published many books on the subject, and in 1897 founded, and became first editor of the authoritative annual *Jane's Fighting Ships*. In 1909 he founded a companion work entitled *Jane's All the World's Aircraft*.

JANE EYRE, a novel by Charlotte Brontë, published under the pseudonym "Currer Bell" in 1847. For its day, it was a most unconventional novel. It came in the wake of sentimental novels in which the heroines were perfect and lifeless beings, and the heroes were all handsome and correct in their conduct. Against this unreality *Jane Eyre* was a protest, highly emotional, not to say hysterical. The author, the daughter of a Yorkshire clergyman, had grown up amid the hard surroundings of a bleak parish on the moors, and of boarding schools where the children were ill treated and ill fed. At the age of 30 she decided to put her own rebellious spirit into a novel, which should also follow in some degree the details of her own life.

Instead of being rich and beautiful, Jane Eyre is a poor and obscure girl, very small and plain in stature, with pale cheeks and green eyes. But she has a keen intelligence, and is thoroughly honest, outspoken and brave. In this heroine of a new type, Charlotte Brontë sought to depict a young woman who should be true to her opinions, true to herself, under all circumstances, whatever might be the consequence to herself or to others. Likewise the hero, Edward Rochester, was of a kind new to fiction. He was unshapely, his features were large and distorted and he had had an unsavory past. Nevertheless Jane Eyre fell in love with him, to the consternation of readers. There had never been in fiction any proposal of marriage like Rochester's, nor any acceptance like Jane Eyre's, on that moonlit night which ended in thunder and lightning and a deluge of rain.

Though the novelty of *Jane Eyre* has partially worn away, it still remains a most interesting story. It was admired by Thackeray, to whom the second edition was dedicated; and Trollope praised its just balance between the ordinary incidents of real life and extraordinary occurrences, such as an interrupted marriage, strange premonitions, dreams and a spectre. *Jane Eyre* was a sincere book, written by the sincerest of women.

WILBUR L. CROSS.

JANESVILLE, jānz'vīl, city, Wisconsin; seat of Rock County; altitude 800 feet. It is located on both banks of the Rock River, 32 miles southeast of Madison, and is served by the Chicago and North Western, and the Chicago, Milwaukee, St. Paul and Pacific railroads. It has regular air service. A center of trade for a region of dairy farming and the growing of grains

and tobacco, Janesville has diversified industries, the products of which include automobiles, automobile bodies, fountain pens, woollens, cotton goods, thread, shades and awnings, and metal fencing. The educational, civic, and cultural resources of the city include good schools, a public library, hospital, civic music association, Little Theater, and service and social clubs. Janesville has the lowest illiteracy percentage among Wisconsin cities. Its public park system is recognized as one of the best in the state. The Wisconsin State School for the Blind is located here. This school, established as a private enterprise, was acquired by the state in 1850, and ranks as the oldest among Wisconsin's welfare institutions.

Janesville is one of the oldest cities of the state. It was first settled in 1835. Incorporation was effected in 1853, and the city became the county seat in 1859. Local points of interest include a soldier's monument; the birthplace of Carrie Jacobs Bond, composer of popular songs; and the one-room schoolhouse where Frances E. Willard taught. The city was named in honor of Henry F. Janes, an early settler. It has the council-manager form of government. Pop. 35,164.

JANET, zhâ-ně', **Pierre Marie Félix**, French psychologist and neurologist; b. Paris, May 30, 1859; d. there, Feb. 24, 1947. He was educated at the École Normale Supérieure and the École de Médecine, Paris. After teaching at several lycées, he was director of the laboratory of pathological psychology at the hospital of La Salpêtrière in Paris, 1889-1898; lecturer at the Sorbonne, 1898-1902; and professor of psychology at the Collège de France from 1902. He is known especially for his researches in mental pathology and his investigations of hysteria by the use of hypnosis.

Janet laid the foundation of automatic psychology in his *L'automatisme psychologique* (1889), and was the first to describe psychasthenia (*Les obsessions et la psychasthénie*; 1903). His other works include *L'état mental des hystériques* (1893); *Névroses et idées fixes* (1898); *The Major Symptoms of Hysteria* (1908; consisting of a series of lectures delivered at Harvard University); *Les méditations psychologiques* (1920); *De l'angoisse à l'extase* (1926, 1928); and *Cours sur l'amour et la haine* (1933).

JANEWAY, jân'wā, **Edward Gamaliel**, American physician; b. New Brunswick, N. J., Aug. 31, 1841; d. Summit, N. J., Feb. 10, 1911. In 1860 he was graduated from Rutgers College, and four years later from the College of Physicians and Surgeons in New York. He was professor of pathology and practical anatomy at Bellevue Medical College, 1872-1879; professor of diseases of the mind and nervous system, 1881-1886; professor of medicine, 1886-1892; and dean 1898-1905. He was also commissioner of health of New York City from 1875 to 1881, and president of the New York Academy of Medicine, 1897-1898. Janeway was one of the most eminent medical diagnosticians and consultants of his day in the United States.

Janeway's nodes, which he described, are small hemorrhagic lesions, generally on the palms and soles, resulting from bacterial endocarditis.

JANEWAY, Theodore Caldwell, American physician; b. New York, N. Y., Nov. 2, 1872;

d. Baltimore, Md., Dec. 27, 1917. The son of Edward Gamaliel Janeway, he was graduated from Yale in 1892 and from the College of Physicians and Surgeons, New York City in 1895. He immediately entered his father's office, serving at the same time as instructor in bacteriology at his alma mater. In 1898 he became instructor and later lecturer at Bellevue Hospital Medical College. He resigned in 1907 to become associate professor of clinical medicine at the College of Physicians and Surgeons and became Bard Professor of Medicine two years later. He was largely responsible for the merger of the Presbyterian Hospital with the College of Physicians and Surgeons, thus forming the nucleus of the medical center on Washington Heights, New York City. In 1907 he became secretary of the Russell Sage Pathological Institute and in 1911 a scientific director of the Rockefeller Institute for Medical Research. He was called to Johns Hopkins Hospital in 1914 to become professor of medicine and head of the hospital. He helped establish a post graduate school for the study of tuberculosis at Saranac Lake. When the United States entered World War I he took charge of the section of cardiovascular diseases of the Division of Internal Medicine. The heavy work thus put upon him led to his early death.

His chief published work was *The Clinical Study of Blood Pressure* (1904). He was perhaps the first to make routine use of this resource in the clinic and introduced the first practicable apparatus for this purpose, called for him Janeway's sphygomomanometer.

JANICULUM, jā-nīk'ŭ-lŭm, or **MONS AUREUS**, mōnz ô'rê-ŭs (modern MONTE GI-ANICOLO), a ridge a little more than three miles long on the west bank of the Tiber, opposite ancient Rome. It rises to a height of 300 feet above sea level and affords a fine view of the modern city, being immediately southeast of Vatican City. It was fortified as a defensive outpost at an early date. The Janiculum was first connected with Rome by the Sublician Bridge; the Aemilius Pons was added in 181 B.C.; the Pons Valentinianus in 366 A.D. It was included in the city limits by Augustus, becoming the 14th Ward (or Region) as Trans Tiberim (modern Trastevere), and was enclosed by a salient of the Wall of Aurelian (built 271-275 A.D.). Through the Porta Aurelia (modern Porta San Pancrazio) in the point of this salient, the Via Aurelia left the city. The Trans Tiberim was chiefly an industrial section, with water power supplied by the Aqua Traiana. The aqueduct of the Aqua Traiana was built by Trajan in 109 A.D. and restored in 1611 by Pope Paul V, hence the modern name of Acqua Paola.

JANIN, zhâ-nān, **Jules Gabriel**, French critic; b. St. Étienne, Department of the Loire, Feb. 16, 1804; d. Paris, June 20, 1874. He was educated at Saint Étienne and at the Collège Louis-le-Grand; studied law and became a private tutor in the Latin quarter of Paris; and then turned to literature, becoming editor, novelist, journalist and critic. He soon became a contributor to several papers, notably the Liberal opposition paper *Le Figaro* and the government paper *Quotidienne*, and in 1836 became connected as dramatic critic with the *Journal des Débats*, in the columns of which he wrote for nearly 40 years. He possessed a wonderful

piquancy of style and an airy grace of sentiment and wit, which made him a delightful retailer of small talk; as a critic, however, he was utterly inconsistent through lack of any general principles of judgment, and said the first thing that entered his mind, though fortunately his lack of judgment was linked with amiability. He was an indefatigable worker and was in constant demand by the publishers of Paris to review books, write prefaces, and do other literary work. Of his published works, one or two of which are remarkable both in substance and style, the following are noteworthy: *L'ane Mort et la Femme Guillotinée* (1829), which went through several editions; *Histoire de la littérature dramatique en France*, 6 vols. (1858), a selection of his weekly *feuilletons*, altered and remodeled so as to present a sketch of the history of the French stage and dramatic artists during nearly a quarter of a century; *Rachel et la tragédie*, a biographical and critical work upon that great tragic artist, with photographic illustrations (1859), and a translation of *Horace* into French, 6th ed. (1885). His *Oeuvres diverses*, 12 vols. (1876-1878), and *Correspondence* (1877) appeared after his death.

JANIN, jän'in, Louis, American mining engineer: b. New Orleans, La., Nov. 7, 1837; d. Santa Barbara, Calif., March 6, 1914. He did much to further the development of western mining. He was educated at Yale university, at the mining academy in Freiberg, Saxony, and at the school of mines in Paris. After practicing mining engineering in California, he turned his attention to the treatment of silver ores, especially on the Comstock lode in Nevada, and worked out a system to overcome the costly waste in extracting the metal from the ores. For a year during the 1870's he was adviser to the Japanese government about the development of the country's gold, silver and copper mines. Among the many young American engineers who received their early training with him were Herbert Hoover and John Hays Hammond.

JANINA or JANNINA. See IOANNINA.

JANIS, jän'is, Elsie (real name **ELSIE BIERBOWER**), American actress: b. Columbus, Ohio, March 16, 1889; d. Beverly Hills, Calif., Feb. 26, 1956. She made her stage debut in *The Charity Ball* at the age of eight in her native city, and soon began to tour the vaudeville circuits. A successful run in New York City in *When We Were Forty-one* (1905) brought her the starring role in *The Vanderbilt Cup* (1906). Other successes followed, and in 1911 she appeared in a play of her own, *A Star for a Night*. During World War I she won international fame as the "Sweetheart of the AEF," entertaining troops overseas. She later produced several editions of her own revue, *Elsie Janis and Her Gang*, retiring in 1928.

JANITSCHKEK, yän'ně-chěk, Hubert, Austrian art historian: b. Troppau, Silesia, Oct. 30, 1846, d. Leipzig, June 21, 1893. He was educated at the university at Gatz 1868-1873, and from the latter year until 1877 pursued the study of art history in Italy. From 1877-1879 he was custodian of the Austrian Museum of Art and Industry in Vienna, and was subsequently professor in the universities of Prague (1879), Strasbourg (1881) and Leipzig (1891). He was the author of the following biographies in Robert Dohme's *Kunst*

und Künstler collection: Andrea del Sarto, Bellini, Paolo Veronese, Il Tintoretto, and others, and also wrote *Die Gesellschaft der Renaissance in Italien und die Kunst* (1879); *Zwei Studien zur Geschichte der karolingischen Malerei* (1885); *Geschichte der deutschen Malerei* (1890); *Dantes Kunstlehre und Giotto's Kunst*.

His wife, **MARIE** (b. Vienna, July 23, 1859) became known as a poet and novelist, her principal works being *Legenden und Geschichten* (1885); *Im Kampf um die Zukunft*, an epic poem (1887); *Gesammelte Gedichte*, 2 vols. (1892); *Aus Alten Zeiten* (1900); the novels *Aus der Schmelde des Lebens* (1890); *Lichthungrige Leute* (1891); *Atlas* (1893); *Gott hat es gewollt* (1895); *Frauenkraft* (1900); *Harter Sieg* (1901), etc.

JANIUAY, hä-ně-wī, municipality, Philippine Islands, of the Province of Iloilo, Panay, situated 19 miles northwest of the city of Iloilo, near the Jalaur River. It lies in a hilly country raising rice and sugar cane, and petroleum has been reported in the vicinity. Pop. (1948) 44,348.

JANIZARIES, jän'i-zēr-ēz (Turkish *jenitcheri*, new soldiers), an infantry force of Turkey, first organized by the Sultan Orkhan about 1330, and in 1362 increased to about 10,000 by Amurath (Murad). Only Christian populations were levied upon for boy recruits who, during training, were instructed in the Islamic faith. Accorded special privileges, the janizaries formed an elite body of highest *esprit de corps* that more than once saved the empire. Boasting they had never fled in battle, they were the nerve and sinew of the Ottoman Army. The regular troops of janizaries at one time numbered 60,000 or more, but they were afterward reduced to 25,000. They were kept in barracks in Constantinople and a few other cities. The irregular troops amounted to 300,000 or 400,000, and were scattered among all the cities of the empire, in time of peace performing police duties. The janizaries who constituted the sultan's bodyguard became in time so dangerous and their insurrections so frequent that several unsuccessful attempts were made to reform or disband them. In 1826 they rebelled on account of a proposal to form a new militia, when the sultan, Mahmud II, having displayed the flag of the Prophet, and being supported by their commander in chief, defeated the rebels and burned their barracks, and many of them perished in the flames. A royal proclamation abolished the corps. As many as 15,000 were executed, and 20,000 banished.

JANK, yängk, Angelo, German artist: b. Munich, Oct. 30, 1868; d. there, Oct. 9, 1940. Educated at Munich Academy under Paul Höcker and Ludwig von Löfftz, in 1907 he was appointed to a chair there. He is best known for his execution of hunting scenes. In 1909 his *The Hunt* and *The Horsewoman* were exhibited at the Metropolitan Museum, New York. In addition to these he has executed *Mailed Defense*; *The Hurdle Race*, in the Elberfeld Museum; equestrian portrait of the duke of Saxe-Coburg-Gotha; *Princess and Swineherd*, in Munich. His colored lithographs are also well known.

JANKO, yön'kō, Paul von, Hungarian pianist and inventor: b. Totis, Hungary, June 2, 1856; d. Constantinople, March 17, 1919. He made his

musical studies at the Conservatory of Vienna and in Berlin under Heinrich Ehrlich. His execution on the piano was hampered through his inability to reach an octave. He therefore invented (1882) the keyboard known by his name and made several tours in 1886–1890 to show its practicability, first in London and later in New York City. The Jankó keyboard has six rows of keys placed fanwise in a semicircle, with three keys to each note, one below the other. Octave and chord fingering are much easier and simpler than on the standard keyboard. Jankó's chromatic keyboard can be attached to any pianoforte, grand, upright, or square. A Jankó Society was founded in Vienna in 1905 to promote the use of the new keyboard, but, despite the invention's undoubted merit, it did not come into popular use.

JANNES AND JAMBRES, jän'ěz, jäm'-brěz, the two Egyptian magicians who opposed Moses in the contest before the pharaoh of Egypt (Exodus 7:11–12, 22). The legend is that they were so much impressed by Moses' wondrous magic that they became his proselytes and accompanied the Israelites on their journey to the Promised Land. According to one account, they perished in the Red Sea crossing; according to another, they urged Aaron to make the golden calf and were killed in the ensuing turmoil. Jannes and Jambres are mentioned by St. Paul in II Timothy 3:8, in the apocryphal Gospel of Nicodemus (4th or 5th century A.D. in its present form), and in the anonymous *Apostolic Constitutions* (4th century A.D.). There are also several references to them in other ancient works. Both Pliny the Elder and Lucius Apuleius mention Moses and Jannes as the names of ancient magicians; Origen and Eusebius quote Numenius, a Greek philosopher of the 2d century A.D., as giving an account of the two magicians.

JANNET, zhà-ně', **Claudio**, French economist: b. Paris, France, March 22, 1844; d. there, Nov. 21, 1894. He was educated as an advocate and became professor of political economy at the Catholic Institute of Paris. A disciple of the sociologist-economist Pierre Guillaume Frédéric LePlay (1806–1882), he advocated social reform within the framework of existing institutions, to be achieved by moral influences rather than by state intervention. His principal works include *Les États-Unis contemporains* (1876; 4th ed., 1889; written after an extended stay in North America); *Le socialisme d'état et la réforme sociale* (1889); and *Le capital, la spéculation et la finance au XIX^{me} siècle* (1892), stressing political-cultural effects on economic development.

JANNEY, jän'ī, **Eli Hamilton**, American inventor: b. Loudoun County, Va., Nov. 12, 1831; d. Alexandria, Va., June 16, 1912. He served as a Confederate quartermaster in the American Civil War and then worked as a drygoods clerk in Alexandria. Despite his lack of mechanical experience, he began to experiment on an automatic coupling for railroad cars and in 1868 secured his first patent. In 1873 he patented an improved device, which remains the basic model for the couplers now in use; the Janney Car Coupling Company was formed the same year to manufacture the device. In 1888 railroads throughout the United States adopted the Janney coupler as modified by further improvements in the intervening years.

JANNEY, Samuel McPherson, American Quaker leader and author: b. Loudoun County, Va., Jan. 11, 1801; d. April 30, 1880. He left school at the age of 14 to work in a counting house, but continued his education through night classes and private study. To pay his debts incurred from an early business failure, he conducted a girls' boarding school, but his business ventures were secondary to his interest in literature and humanitarian work. For nearly 50 years he was influential in the Hicksite division of the Quaker sect, working for the emancipation of the Negro, for public schools, and for the economic betterment of Indians. His literary work includes the authorship of the biographies of two great Quakers, *The Life of William Penn* (1852) and *The Life of George Fox* (1853), valuable for their source material and fine scholarship. He also wrote the meticulous study, *History of the Religious Society of Friends, from its Rise to the Year 1828* (4 vols., 1860–1867), and his fascinating autobiography, *Memoirs* (1881).

JANNINGS, jän'ingz, Ger. yän'ings, **Emil**, German-American actor: b. Brooklyn, N.Y., July 23, 1887; d. Sankt Wolfgang, Austria, Jan. 2, 1950. His family returned to Europe when he was an infant, and he attended school in Germany before joining a traveling circus at the age of 16. He was discovered as an actor by the director Max Reinhardt and engaged at Berlin's Deutsches Theater, where he appeared in Shakespearean roles and in plays by modern European dramatists. During and after World War I he appeared in many German silent films, notably *Waxworks* (1924), *The Last Laugh* (1924), *Variety* (1925), and *Tartuffe* (1925). He went to the United States in 1926 and won stardom in several Hollywood productions, including *The Last Command* (1926) and *The Patriot* (1928). Because of his refusal to learn English, the advent of the talking motion picture caused him to return to Germany. He continued his film and stage work there and in Austria until his death. Probably his best-known motion picture performance was with Marlene Dietrich in *The Blue Angel* (1930).

JANOW, jän'ów, **Matthias von**, medieval theologian and reformer: b. probably Prague, Bohemia (now Czechoslovakia); d. there, Nov. 30, 1394. The son of a Bohemian knight, he studied theology at the University of Prague and later spent nine years at the University of Paris. While visiting Rome in 1381, he was appointed canon of the Cathedral of St. Vitus at Prague and confessor to Charles II, continuing in that office until his death. He had no oratorical ability, but through his writings exercised a remarkable influence on the religious thought of his time. His writings were collected in a work entitled *Regulae veteris et novi testamenti* (1392). In this book Janow denounced the corruption and evil that existed in the church, alleged gross misconduct of bishops and priests, and urged that all human additions to Christianity, both doctrinal and ceremonial, be eliminated and that the church return to its original beliefs and doctrines. He had advocated also the removal of images from the church and had recommended daily communion, but after the Synod of Prague (1389) had discouraged these reforms, he publicly retracted his opinions and vowed complete loyalty to the church. His writings

were declared heretical, and 16 years after his death were publicly burned with those of John Wycliffe. Janow has often been called a precursor of John Hus (q.v.).

JANS, yāns, **Anneke** or **Annetje**, Dutch colonist in North America; d. Albany, N.Y., 1663. She emigrated from the Netherlands in 1630 with her husband Roeloff Jansen, who secured in 1636 a grant on lower Manhattan Island for 62 acres of land, to which Anneke obtained a patent right in 1654. The possession of this property was subsequently the subject of numerous lawsuits. In 1671 some of her heirs sold the land to Governor Francis Lovelace. In 1673 it was confiscated by the British, who deeded it to Trinity Church in 1705. From 1749 this valuable property has been claimed by the descendants of Anneke Jans, chiefly on the legal grounds that the names of two heirs were omitted from the original deed of transfer, but the courts have always upheld the defendants.

JANSEN, jān's'n, Du. yān'sēn, **Cornelius** (Lat. CORNELIUS JANSENIUS), Dutch theologian: b. Acquoï, near Leerdam, the Netherlands, Oct. 28, 1585; d. Ypres, Belgium, May 6, 1638. He acquired his philosophical training at the Collège du Faucon, one of the University of Louvain's arts colleges, graduating 1st in a class of 118 students. He then transferred to the Collège du Pape Adrien VI, where he studied theology under Jacques Janson, the celebrated disciple of Michael Baius, whose influence was to color the whole of Jansen's career. Returning to Louvain in 1616, Jansen headed the Collège de Sainte-Pulchérie, taught theology, chiefly to Dutch students, and became noted for his lectures and commentaries. His scholarly pursuits centered on the revival of St. Augustine's doctrine of grace and free will, which, he believed, was neglected by the church. He denounced the Jesuits as Pelagians or Semi-Pelagians and in turn was opposed by them for his extremism. In 1636 he was named bishop of Ypres. Despite heavy administrative work Jansen managed to complete the theological treatise which he had begun many years earlier. It was published two years after his death under the title, *Augustinus, seu doctrina Sancti Augustini de humanae naturae sanitate, aegritudine, medicina, adversus Pelagianos et Massilienses*. In this work he expounded his main theses that original justice belonged to man's nature, that fallen man is radically corrupt, and that the redemption of Christ extended only to the predestinate, and the nonpredestinate lack grace to resist sin. These points of doctrine constitute the principles of the heresy known as Jansenism (q.v.). Jansen's extremist theological inclinations were not known during his lifetime, and he died in the good graces of the church. His complete heterodoxy became apparent only after the *Augustinus* had appeared in print and had been condemned by the church.

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JANSENISM, jān'sēn-iz'm, a 17th century religious doctrine on the nature of grace and free will taught by Cornelius Jansen (q.v.). The teaching was declared erroneous by the Roman Catholic Church and its adherents were labeled heretical. Essentially, Jansenism represents an antidog-

matic and antimystical reaction to traditional Christianity. Its basic divergences consist of a belief in the mutilation of human nature through Adam's fall, an acceptance of predestination with no allowance made for man's merits, and a denial of the universal salvific will of God. Practically, it presents a rigid application of moral principles, particularly with reference to dispositions required for worthy reception of Holy Communion.

Origin, Nature, and Condemnation.—Jansen imbibed his opinions from Jacques Janson, a disciple of Michael Baius, while at the University of Louvain. He denounced the Jesuit teachings on grace as Pelagian or Semi-Pelagian and rejected St. Thomas Aquinas' doctrine as opposed to St. Augustine's. For 20 years Jansen labored on a treatise supposedly designed to revive true Augustinianism. The full title of his work is *Augustinus, seu doctrina Sancti Augustini de humanae naturae sanitate, aegritudine, medicina, adversus Pelagianos et Massilienses*. Its orthodoxy was suspect from the very beginning. Notwithstanding a papal directive that no books dealing with grace and free will should be printed, the work was published secretly under the auspices of the University of Louvain in 1640. Urged by the Jesuits, Paul Richard Stravius, the papal internuncio, requested the university to stop publication. Later Pope Urban VIII ordered that this be done, but the decree came late. The book was rushed through the press and in the following year was reprinted in Paris with approval of the Sorbonne.

The work became the subject of public controversy. Several Catholic bishops and theologians favored its doctrine; Dutch Calvinists adopted the book for presenting their own teaching; the Jesuits denounced it most vigorously. The aging Pope Urban VIII failed to take immediate action, but his vice chancellor and nephew, Francesco Cardinal Barberini, invoked Pius V's ban on public discussion of points connected with the question of grace, and all writings related to the controversy were ordered confiscated. However, the heresy continued.

At length Urban VIII issued a bull, *In eminenti* (June 19, 1643), against the errors, stating that "a careful reading of the *Augustinus* has shown that it contains and defends many propositions which our predecessors have condemned, to the great scandal of Catholics and disrespect for the authority of the Holy See."

After the death of Jansen's close follower, the Abbé de Saint-Cyran (Jean Duvergier de Hauranne), in 1643, leadership of the sect passed into the capable hands of Antoine Arnauld (see ARNAULD). A gifted writer, scholar, and tenacious worker, the "Great Arnauld" directed the destinies of the group for over 50 years. Practical applications of the doctrine were made in various areas of theology. Arnauld's most notable contribution was the book *De la fréquente communion* (1643), in which he laid down conditions for the reception of the sacrament so exacting that the Eucharist could rarely be received.

In 1649 an official of the Sorbonne summarized the contents of the *Augustinus* in five propositions:

1. Some of God's commandments are impossible to the just, who desire and strive to keep them, with the powers that they have at present; the grace by which these commandments can be possible is also lacking.
2. In the state of fallen nature no one ever resists interior grace.

3. In order to merit or to demerit, in the state of fallen nature, freedom from external constraint is necessary, but not freedom from interior necessity.

4. The Semi-Pelagians admitted the necessity of interior preventing grace for all action, even for the beginning of faith; and they were heretics in teaching that this grace is such that men may either follow or resist.

5. It is Semi-Pelagian to say that Christ died or shed His blood for all men.

Efforts were made to interpret these in the light of St. Augustine's writings. However, on May 31, 1653, Pope Innocent X, successor to Urban VIII, condemned them as heretical.

Reaction to Papal Decrees.—The clever Arnauld found a way around the condemnation. He agreed that the five propositions were certainly heretical and deserving of censure, but, he maintained, they were not found in the *Augustinus* in the sense condemned. With this the conflict acquired a new character. Controversy now centered on the binding power of ecclesiastical judgments. Arnauld argued in effect:

(1) The church has a right to condemn error or false doctrine and is qualified to judge with regard to the revealed origin and heterodoxy of a truth.

(2) The fact as to whether error is found in a given work in the sense in which it was declared heretical is not within the scope of the church's power to decide.

Thus, with reference to the first (question of right), submission of the faithful was required; with reference to the latter (question of fact), the ecclesiastical judgment should not be challenged publicly, but interior assent need not be given.

Not all Jansenists accepted the escape offered by Arnauld. Blaise Pascal (*Lettres provinciales*, 1656) chided the Sorbonne for considering the distinction. At the same time he denounced the Jesuits for what he considered a casuistic corrupt moral doctrine. In 1656 the Assembly of Bishops at Paris branded Arnauld's distinction heretical, and Alexander VII, successor of Innocent X, in a bull, *Ad sanctam Petri sedem* (Oct. 16, 1656), explicitly condemned the five propositions in the sense taught by Jansen. On Feb. 15, 1664, he issued a constitution, *Regiminis apostolici*, whereby all ecclesiastics and religious were obliged to repudiate Jansenism under oath. Those refusing were made subject to canonical judgments. King Louis XIV sustained the pope in this action.

Peace of Clement IX and Renewal of Conflict.—Alexander VII was succeeded by Clement IX in 1667, when Gallicanism, quietism, and other problems held the attention of ecclesiastical authorities and when most Jansenists were confining themselves to a denial of the church's power to decide cases of fact. This period of quiet on the question came to be known as the "Peace of Clement IX."

In a few years, however, the old theories reappeared in connection with the "case of conscience"—that is, whether it was licit to absolve penitents who sympathized with certain Jansenistic theories. The practice was condemned by Clement XI (July 16, 1705) on grounds that ecclesiastical judgments required interior assent. A few years earlier, in 1687, had appeared Pasquier Quesnel's *Réflexions morales*, in which Jansen's errors were reiterated. Louis Antoine de Noailles, bishop of Châlons-sur-Marne and later cardinal archbishop of Paris, approved the book. After its condemnation by Clement XI, he found himself obliged to retract the approbation, but hesitated. Finally, on Sept. 8, 1713, in a bull, *Unigenitus*, 101 propositions taken from the *Réflexions* were anathematized by Clement XI.

De Noailles and four bishops appealed for a general council. The pope rejected the appeal and excommunicated the recalcitrants. In France 1 cardinal, 18 bishops, and about 3,000 clerics were, for all practical purposes, in schism. On the side of orthodoxy were 4 cardinals, about 100 bishops, and scores of clerics. The conflict continued until Cardinal de Noailles submitted to the Holy See in 1728.

This action dealt the cause a severe blow, and Jansenism has declined ever since then. Gradually followers were reduced to a mere handful except in the Netherlands. Several vicars apostolic to the Netherlands were favorably inclined toward the doctrine. Johann de Neercassel, apostolic vicar from 1663 to 1686, openly supported the movement and provided refuge for Jansenists driven from other nations. In 1723 a bishop was elected for the sect in the see of Utrecht and was consecrated by the excommunicated Bishop Dominique Varlet. The see is still maintained. Whenever a new bishop has been elected, Rome is notified and forthwith nullifies the election and excommunicates all persons concerned. In 1956 the sect had about 5,000 followers, most of whom were in the Netherlands.

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JANSON, yän'sön, Kristofer Nagel, Norwegian novelist and educator: b. Bergen, Norway, May 5, 1841; d. Christiania (now Oslo), Nov. 17, 1917. Although educated for the ministry at the University of Christiania (Oslo), he became interested in the movement for popular education and established a popular high school in Sel, a district of Gudbrandsdalen, and later in Gausdal. He lived in the United States from 1879 to 1893, settling in Minneapolis, Minn., where he was the pastor of a Unitarian church and also the editor of a Norwegian language Unitarian newspaper, *Saamanden* (*The Sower*). Returning to Norway, he became the first writer of the new Norse dialect to be granted a poet's pension by the Norwegian Storting. Janson was much in demand as a lecturer because of his striking appearance, musical voice, and kindly manner. He was a friend of Björnsterne Björnson and imitated the style of this great Norwegian writer in his own work. His prose output was voluminous and his novels were once widely read in Norway, but his works lacked artistry and are now largely neglected. His major novels are *Han og ho* (1868); *Fraa Dansketidi* (1875); *Den bergtekne* (1876); tr. *The Spell-Bound Fiddler*, 1880); *Vore bedsteforældre* (1882).

JANSSEN, yän'sën, Johannes, German Roman Catholic historian: b. Xanten, Germany, April 10, 1829; d. Frankfurt am Main, Dec. 24, 1891. Educated at the universities of Louvain, Bonn, and Berlin, he was professor of history in the gymnasium at Frankfurt am Main in 1854. In 1860 he became a priest and 20 years later was appointed domestic prelate to the pope. He is chiefly known for his 8-volume *Geschichte des*

deutschen Volkes seit dem Ausgang des Mittelalters (*History of the German People from the End of the Middle Ages*), published between 1876 and 1894, the last two volumes posthumously. Written from a strictly Catholic point of view, it was attacked by Hans Delbrück and other historians.

JANSSEN, Peter, German painter: b. Düsseldorf, Germany, Dec. 12, 1844; d. there, Feb. 19, 1908. From his father Teodor Janssen, a noted engraver, he obtained his early art education. In his 16th year he entered the Art Academy at Düsseldorf and became a pupil of Eduard Bendemann (1811-1899) and of Carl Ferdinand Sohn (1805-1867). Appointed a professor at the same academy in 1877, he became its director in 1895. Janssen distinguished himself as a painter of murals. In 1872 he completed for the Bremen Exchange a huge wall painting representing *The Colonization of the Baltic Coast*, and two years later he decorated the walls of one of the halls of the National Gallery at Berlin with wax paintings dealing with the *Myth of Prometheus*. The murals he painted during 1880-1882 for the town hall at Erfurt, entitled *Momentous Episodes in the History of Erfurt*, are outstanding examples of Janssen's use of color and his talent for dramatic composition.

JANSSEN, zhān'sen', Pierre Jules César, French astronomer: b. Paris, France, Feb. 22, 1824; d. Meudon, Dec. 23, 1907. Graduating in 1852 as licentiate in mathematics and in 1860 as doctor in physics, his thesis on the absorption of dark radiating heat within the eye created widespread discussion. In 1853 he became temporary professor in the Lycée Charlemagne, and from 1865 to 1871 was professor of general physics in the Special School of Architecture. In 1857 he traveled to Peru to fix the location of the magnetic equator; from 1861 to 1864 he was in Italy observing the solar spectrum; and from the latter year until 1867 he was in the Azores with Charles Sainte-Claire Deville. In 1867 he visited Santorin, Greece, to study the volcano there, and in 1868 went to Guntoor, India, to observe the total eclipse of the sun, making special observations on the solar prominences. In 1870, during the Franco-Prussian War, he escaped by balloon from besieged Paris in order to observe in Algeria the solar eclipse. He watched the transit of Venus in Japan (1874). A year later he was astronomer for an English expedition to Siam, and also was appointed director of the astrophysical observatory at Meudon. Having founded an observatory on Mont Blanc in 1892-1893, he was appointed its director. (See also *ECLIPSE—Phenomena Observed in Total Solar Eclipses*.)

JANSSEN, yān'sēn, or JANSEN, Zacharias, Dutch spectaclemaker: b. The Hague, Netherlands, c. 1588; d. Amsterdam between 1628 and 1632. Active at Middleburg, he was credited with the invention of both the compound microscope and the telescope by the French physician Pierre Borel (1620-1689) in his *De vero telescopii inventore* (1655). However, though later historians tend to agree that Janssen together with his father Hans discovered the microscope, some authorities contend on the basis of Dutch documents that the discovery of the telescope belongs either to Hans Lippershey (d. 1619) or to Jacobus Adriaanszoon, both active at Middleburg

and Janssen's contemporaries.

JANSSEN VAN CEULEN, yān'sēn vān kù'lēn, Cornelius, English portrait painter: b. London, England, c. 1593; d. in the Netherlands, c. 1664. He worked at his art for many years and was rewarded in 1618 by appointment as the fashionable painter at the English court. He maintained his pre-eminence until Anthony van Dyck came to England and was made the official court painter. Janssen went to the Netherlands in 1643 and lived there until his death. His work is refined, shows infinite care, and portrays his powers as colorist. His original and skillful technique of throwing features into high relief by providing a dark background has seldom been excelled. His best portraits are those of Charles I, the Duke of Buckingham, John Milton as a boy, and *The Magistrates*. He is represented in many private collections, also in the collections of museums at Rotterdam, Lille, Dresden, and Brunswick.

JANSSENS, yān'sēns, Abraham (called JANSSENS VAN NUYSEN), Flemish painter: b. Antwerp, the Netherlands, 1575; d. there, Jan. 25, 1632. From early youth he showed aptitude for painting, and when 18 years of age became a pupil of Jan Snellinck. Admitted as a master to the Guild of St. Luke in 1601, he was the guild's dean from 1606 to 1607. Subsequently he visited Italy. One of the most distinguished of Romanist Flemish painters, contemporaries admired his excellent drawing, fine sense of color, and clarity of composition. Outstanding among his works are the *Madonna with Saints* and the *Entombment* in the Carmelite church at Antwerp; *The Descent from the Cross* in the Cathedral of St. Bavon at Ghent; *The Adoration of the Magi* in the Antwerp Museum; and *Venus and Adonis* and *Day and Night* in the Vienna Museum.

JANSSENS, Francis, Roman Catholic archbishop: b. Tilburg, The Netherlands, Oct. 17, 1843; d. on board steamer *Creole* voyaging from New Orleans to New York, N.Y., June 10, 1897. The son of a wealthy Catholic family, at the age of 13 he entered the seminary at Bois-le-Duc. In 1866 he was ordained subdeacon and the following year a priest. After further religious studies at the American college attached to the University of Louvain, he came to the United States in 1868, serving successively as pastor of the cathedral at Richmond, Va., as vicar general, and administrator of the diocese. Consecrated bishop at Natchez in 1881, he was appointed archbishop of New Orleans seven years later. A tireless worker, he improved the archdiocesan finances, opened in 1892 a mission, a free school, and an asylum for Italian orphans. With the help of Thomy Lafon, a Negro humanitarian, he provided for the needs of the aged colored. Largely through his efforts the Louisiana Lepers' Home was set up, also the Catholic Winter School of America.

JANUARIUS, jān-ū-ā'ri-ūs, SAINT (Ital. SAN GENNARO): b. 272?; d. Pozzuoli, Italy, Sept. 19, 305. Bishop of Beneventum in 303, he was beheaded at the time of the persecution of the Christians under Emperor Diocletian. The patron saint of Naples, his body lies in the crypt of Naples Cathedral. Two phials of his blood which, according to tradition, a pious matron

caught at his execution, are preserved in one of the chapels. The blood, on being brought near the head of the saint, is said to liquefy. A trial is made during three festivals a year, the chief being the anniversary of his martyrdom, and also whenever public danger exists or is imminent. If the blood moves briskly in the phials and appears of a clear red, San Gennaro promises well for his city; but if otherwise, it is an evil omen.

JANUARY, jän'ü-ër'ī, the first month of the year held by the Romans sacred to Janus (q.v.), from whom the name was derived. The Roman year originally began with March and consisted of 10 months, Numa Pompilius is said to have added January as well as February to the calendar. However, although the Romans as early as 251 B.C. had accepted January as the first month of the year, the nations of Europe did not universally adopt it as such till the 18th century. *Wulfmonath* was the Anglo-Saxon name for the first month. March 25th was the beginning of the ancient Jewish year, and that day instead of January 1 long held a legal position in Christian countries as the opening of the new year.

JANUS, jā'nūs, an ancient Latin divinity, after whom the first month of the year was named. Presiding over gates, doors (*janus*) and passages (*janua*), he was the protector of entrances and departures. Hence, he was sometimes represented as a porter or doorkeeper with a staff in the right hand and a key in the left. More commonly, however, he was depicted as on the Roman *as* of early coinage, with two faces, usually bearded, looking in opposite directions. Gradually, he was vested with more extensive attributes and was worshiped as god of beginnings, of the beginning of the year and of the month; of the beginning of day, opening the gates of heaven to let out the morning, and closing them when day returned, at dusk. As god of the beginning of time (*temporis auctor*) as well as of the world, he was invoked as "father" at the beginning of all solemn sacrifices. His priest was the *rex sacrorum*. Several sanctuaries, usually in the form of arches, were dedicated to Janus in Rome. The earliest of them, dedicated by Numa Pompilius, as depicted on coins consisted of two parallel arches facing east and west, connected by side walls and furnished with gates. According to an ordinance of Numa these gates were to remain always open in times of war. During the 700 years until the Christian era, they were closed only four times.

JANVIER, jän'vēr, Catharine Ann, American painter and author: b. Philadelphia, Pa., May 1, 1841; d. Merion, July 19, 1922. Born Catharine Drinker and educated at Hong Kong where her father was a merchant, she removed to Baltimore at his death in 1857, studied art at the Maryland Institute there, and then at the Pennsylvania Academy of Fine Arts at Philadelphia. She married Thomas Allibone Janvier (q.v.) in 1878 and with him traveled in Mexico, England, and France. At Saint Rémy, in Provence, she met the Félibrige (q.v.) writer Félix Gras and published in translation his *The Reds of the Midi* (1896), *The Terror* (1898), and *The White Terror* (1899). Mrs. Janvier is said to have been the first to identify William Sharp as the creator of *Fiona Macleod*. Her paintings

include *Geoffrey of Rudel and the Countess of Tripoli*, *The Princess Badroulbador*, and *The Guitar Player*. Several of her lithographs are in the New York Public Library collection.

JANVIER, Margaret Thomson, American author (pen-name MARGARET VANDEGRIFT): b. New Orleans, La., February 1844; d. Moorestown, N. J., February 1913. A sister of Thomas Allibone Janvier (q.v.), she was educated at home and New Orleans public schools. Her writings consist almost entirely of stories and verse for children. Among her better known works are *Clover Beach* (1880); *Doris and Theodora and The Absent-Minded Fairy* (both 1884); *The Dead Doll and Other Verses* (1889); and *Umbrellas to Mend* (1905).

JANVIER, Thomas Allibone, American journalist and author: b. Philadelphia, Pa., July 16, 1849; d. New York, N. Y., June 18, 1913. After a common school education in Philadelphia and a brief spell in business, he turned to journalism and from 1871 to 1880 was an editorial writer with the Philadelphia *Times*, the *Evening Bulletin* and the *Press*. Between 1881 and 1884 he visited Colorado, New Mexico, and Mexico, where he collected material for his books, *The Mexican Guide* (1886), *The Aztec Treasure House* (1890) and *Stories of Old New Spain* (1891). Settling in New York in 1884, he became interested in the history and antiquities of the city, as well as in the Bohemianism around Washington Square; he published *In Old New York* (1894), *The Dutch Founding of New York* (1903), and *Henry Hudson* (1909). A seven-year stay mainly in the south of France brought him and his wife into contact with Provençal literary circles. Among his books treating the life and customs of that region are *Embassy to Provence* (1893), *Christmas Kalends of Provence* (1902) and *From the South of France* (1912). He was made an honorary member of the Félibrige (q.v.) society. Other works are *The Uncle of an Angel*, and *Other Stories* (1891), *Legends of the City of Mexico* (1910).

JAOK, jā-ök', a large sculpin, *Myoxocephalus jaok*, common in the shallow waters along the Bering Sea and into the Arctic. Used locally as a food fish, it is from 12 to 18 inches long, olive grayish above and white below. Like other sculpins, it is capable of living for two days out of water, in cold weather.

JAORA, jou'rā, a former princely Indian state merged since 1948 with Madhya Bharat. Comprising two separate tracts between Neemuch (Nimach) and Ratlam, its area is 601 square miles. A fertile region, it produces cotton, Indian corn, opium and millet. Malwa opium is largely produced in Jaora. Ruled formerly by nawabs of Afghan rule, the native state was guaranteed independence by the British under the treaty of Mandsaur (Mandasor) of 1818. Pop. (1941) 116,953.

JAORA, town, India, and capital of the former princely state of the same name, situated on the Rajputana-Malwa railway, 22 miles north of Ratlam. The town has several substantial buildings of modern construction including a Zenana dispensary and a high school. Pop. (1941) 25,501.

JAPAN (Jap. *NIHON* or *NIPPON*), island empire of eastern Asia. Including the Amami Islands, restored to Japanese sovereignty in 1953, it has an area of 142,798 square miles; its population was 93,418,501 as of the census of 1960. The capital, Tokyo, had a population (1960) of 8,310,027. For administrative purposes, Japan is divided into 46 prefectures.

The basic monetary unit is the yen; in 1963 its value was officially at 360 to the U.S. dollar. The metric system is used for weights and measures. The national flag is white, with a red sun in the center.

The historical, social, and political development of Japan, its economy, religion, literature, arts, and science, are treated under the following headings:

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| 1. The Land | 13. Religion |
| 2. Political Divisions and Population | 14. Cultural Life |
| 3. The People | 15. Scientific Research |
| 4. Natural Resources | 16. The Fine Arts |
| 5. Agriculture | 17. Architecture |
| 6. Industrial Development | 18. Language |
| 7. Trade | 19. Literature |
| 8. Labor Relations | 20. History: From the Earliest Times to 1853 |
| 9. Transportation and Communications | 21. Development of the Modern State (1850-1945) |
| 10. Financial Development | 22. Foreign Relations (1931-1945) |
| 11. Government | 23. Occupation and Foreign Relations Since 1945 |
| 12. Changing Cultural Patterns | |

1. THE LAND. Japan is an insular mountainous land lying between the gigantic mass of the Asiatic continent and the profound oceanic depths of the Pacific Basin. The bulk of its area is included in the four main islands of Honshu, Shikoku, Kyushu, and Hokkaido, but there are many smaller islands adjacent to the larger ones. Between the Japanese islands and the eastern shore of the Asiatic continent lie the relatively deep Sea of Japan, whose maximum depth is 12,178 feet, and the very shallow East China Sea, which, for the most part, overlies the continental shelf. In sharp contrast, the mighty Tuscarora Deep, which occurs just off the eastern or Pacific shores of the Japanese islands, reaches a maximum depth of 30,659 feet.

Japan, without its pre-World War II possessions, is a small country in terms of land area, which totals only 142,798 square miles. The area of the more important islands follows, in square miles:

Honshu	88,031	Amakusa-shimo	220
Hokkaido	30,077	Yaku	193
Kyushu	13,768	Tane	173
Shikoku	6,857	Tsushima-shimo	168
Amami-O-shima	333	Fukae (Goto group)	126
Sado	331	Tsushima-kami	95
Awaji	228	Dogo (Oki group)	95

Topography.—The islands of Japan, without exception, are but a part of the insular arcs of the Western Pacific, which have been formed by the intensive orogenic processes of recent geologic time. Largely in consequence of this, they are composed primarily of high and rugged mountains and contain many volcanoes. These mountain-forming processes are still vigorously active, as is witnessed by the frequency of destructive earthquakes and of violent volcanic eruptions.

The arrangement of mountain ranges and depressed lowlands and the distribution of volcanoes indicate that the form and the major surface features of the Japanese islands are dominated by six main mountain systems. From northeast to southwest these are: (1) the mountain arc ac-

counting for the Kuril or Chishima Islands and continuing into Hokkaido from the northeast; (2) the mountains of Sakhalin or Karafuto entering Hokkaido at its northwest corner; (3) the Tohoku, or northeastern, range dominating the northern half of Honshu and the southern peninsula of Hokkaido; (4) the Seinan, or southwestern, system extending southwestward from central Honshu to form the backbone of the Chugoku Peninsula and to reach its greatest dimensions in the mountains of Shikoku; (5) the Shichito-Mariana chain reaching northward across central Honshu through the Pacific island groups from which its name is derived; and (6) the Ryukyu arc curving northward from Formosa to penetrate Kyushu. Where two or more of these mountain systems join, there occur high mountain masses or knots, extensive plains, and profuse groupings of volcanoes. In the central part of Honshu the Seinan and Shichito-Mariana arcs meet, and here are found the highest mountain lands of nonvolcanic origin in Japan. Here too occurs the Fuji volcanic group, with Mounts Fuji, Akaishi, and Hida (Ontake), whose summits reach 12,395, 10,456, and 10,444 feet, respectively. Also at this juncture of the two great arcs lies the greatest of Japan's lowlands, the Kanto plain. In Hokkaido, where the Tohoku, Kuril, and Sakhalin arcs join, is found the so-called Roof of Hokkaido, with complex clusters of mighty volcanoes. Another highland mass, with groups of volcanoes, is found in Kyushu where the Seinan and Ryukyu arcs meet. The axis lines of these great arcs are marked by mountain masses and extensive plateaus, which are often accompanied by extensive adjoining lowlands. In crossing Hokkaido, the two separated mountain ranges of Sakhalin give rise to the Kitami and Hidaka mountain lands in the eastern part of the island and to the Teshio and Yubari Mountains in the western part. Between them are extensive lowlands. The southwestward extension of the Kuril arc into Hokkaido is expressed in several separated volcanic groups, which reach their highest elevation in Taitsetsu-zan (Asahi-dake) at 7,513 feet in central Hokkaido. Japan's second largest lowland, the Tokachi plain, in the western part of Hokkaido, lies just south of and adjacent to the juncture of the Kuril and Sakhalin arcs.

The Tohoku mountain system comprises the southwestern peninsula of Hokkaido and extends southward to the central part of Honshu. Here both the three mountain chains and the bordering and intervening lowlands run quite exactly parallel to the axis of the Tohoku arc. This is especially pronounced in the central and western portion of northern Honshu. The central range is the highest and forms the backbone of the area. It is surmounted by many towering volcanoes. The Dewa range in the west is much lower and in parts is hardly more than hill country. Between these two ranges is the Median Groove, an intermittent chain of down-faulted basins whose floors afford fertile plains. These three terrain elements—the two mountain ranges and the intervening lowlands—extend northward to form the southwestern peninsula of Hokkaido. The island of Hokkaido, then, is divided into two quite distinct parts in terms of terrain features. Separating these two sharply contrasting divisions is the wide and uninterrupted Ishikari-Yufutsu lowland, which runs north and south between the two bays whose names are combined to identify the plain. A genetic continuation of this lowland extends

southward between the central and eastern ranges of Tohoku. In the far north of Honshu it accounts for the elevated Sambongi-hara or Mutsu plain. Just southward and terminating with the Gulf of Sendai is the Kitakami lowland, which southward from the Gulf of Sendai continues as the Abukuma lowland, including the Fukushima and Koriyama basins. The southernmost extension of this intermontane line of lowlands accounts for the great Kanto plain and the depression occupied by Tokyo Bay. The eastern of the three ranges of Tohoku borders the Pacific shore. It is broken in two by the Gulf of Sendai. The northern half is known as the Kitakami, and the southern is called the Abukuma. Peneplain remnants characterize both of the mountain lands, and both lie somewhat oblique to the general trend of the major arc.

The Shichito-Mariana arc is of tremendous topographic importance to Japan. It is associated with the mighty transverse tectonic depression of the Fossa Magna, which cuts north and south through the center of the main island of Honshu; with the famous and beautiful Fuji-Hakone-Amagi volcanic mountains; and with the high intermontane basins of central Honshu, including Matsumoto, Suwa, Kofu, Zenkoji, and Saku. The high, bordering mountain lands of Akaishi, Kiso, and Hida, though belonging to the Seinan system, seem to have been effected by the same orogenic forces and so trend in the same direction as the Shichito-Mariana arc. As the Shichito-Mariana arc approaches Japan from the Pacific, it gives rise to the spectacular Seven Isles of Izu (Izu Shichito), which are volcanic islands resting upon a submarine range. It then continues northward to form the massive and jumbled volcanic Izu Peninsula, with its famed hot springs and coastal resorts. This volcanic land continues northward and includes the great dissected volcano of Hakone, with beautiful Lake Ashi lying within its large crater. Nearby towers Japan's highest and most beloved mountain, Fuji-san, or Fujiyama, a majestic and nearly perfect conical volcanic cone, rising from sea level to 12,395 feet.

The Fuji volcanic chain continues northward through the Fossa Magna, and the western margin of this great transversal depression is marked by a tremendous and spectacular fault scarp. The eastern margin is also scarp bound, but is much less impressive. Between these scarps and the included volcanic lands of the Fuji chain occur the intermontane basins mentioned above.

The Seinan, or southwest, arc trends nearly due east and west and is divided into three parallel topographic zones. The northernmost lies within the inner zone of Japan and includes from west to east: the Chugoku range, which forms the backbone of the Chugoku Peninsula; the Tamba Plateau, lying just west of Lake Biwa; and the high nonvolcanic lands of Kiso and Hida. Elevations in this zone increase from west to east. Except for the two volcanic peaks of Daisen (5,620 feet) and Hyo-no-sen (4,954 feet) and the monadnock, Kanmuri (Kamori) -yama (4,393 feet), the highest peaks of the Chugoku range barely exceed 3,900 feet, while Hotakadake, at the eastern end of the zone and towering above the Fossa Magna, reaches a height of 10,138 feet.

The southernmost portion of the Seinan system bears the general name of the Kuma-kii mountain land. It belongs to the outer zone of Japan and is broken into four segments by three

water channels—Bungo Strait, Kii Channel, and Ise Bay. The four mountain sections thus separated are uniformly characterized by very rugged terrain features, with sharp ridges and deep V-shaped valleys. From east to west these four areas are known as the Kyushu, Shikoku, Kii, and Akaishi mountain lands. General elevations also increase from west to east, terminating in the Akaishi, the highest nonvolcanic mountains in Japan, where Mount Kita reaches 10,456 feet.

The third and middle portion of the Seinan system is the great depression occupied by the Setonaikai, or Inland Sea. This beautiful body of water presents two contrasting seascapes—the Seto and Nada. The former are stretches of island-studded water and the latter are spacious areas of open sea. The major island groupings from east to west are those of Awaji, Bisan, Geiyo, and Hoyo, which separate the open seas: Izumi-nada, Osaka-wan, Harima-nada, Bingo-nada, Hiuchi-nada, Aki-nada, Iyo-nada, and Suwonada. The great depression which holds the Inland Sea is continued genetically northeastward to account for the down-faulted basins and block mountains of Kinai. The more important of these rich and anciently settled basins of Kinai are the Yamato (Nara), the Yamashiro (Kyoto), the Omi (Biwa), and the Osaka (Settsu). A western extension of the Inland Sea depression also accounts for the down-faulted basins and block mountains of northern Kyushu. These basin plains, like those of Kinai, are rich, long settled, and densely populated. The Chikugo and Chikuzen plains are among these. The southern portion of the depression in Kyushu is largely buried by volcanoes. Here are the famous hot springs of Beppu, the summer resort of Mount Unzen, and the gigantic caldera of Aso, whose floor supports a dense agricultural population as well as a central cluster of new volcanoes, one or more of which are almost constantly active. Still farther west the depression continues to give again the characteristic scenery of the Inland Sea in the Amakusa Islands and Yatsushiro Bay.

The influence of the Ryukyu arc is most marked in the extensive volcanic region of southern Kyushu and in the smaller islands of Japan just south of it. It is probable too that the southward trend of the central Kyushu mountain land results from the orogenic forces of Ryukyu. In the Japanese islands just south of Kyushu three zones are found. Tanegashima, in the east, is a low, flat island of young Tertiary rock. Yakushima, in the center, is a spectacularly mountainous island of much older rock. On this small, circular-shaped island, which is but 16 miles in diameter, the highest peak of Kyushu, Yae-san, reaches 6,348 feet above the sea. The third, or western, zone is composed of a series of volcanic islands which belong to the Tokara volcanic chain and which are genetically continuous with the volcanic lands of southern Kyushu.

Lakes.—Though not particularly numerous and generally not of large size, Japan's lakes fall into three main types. Lake Biwa (Biwa-ko), which is the country's largest lake (278.37 square miles), occupies the western half of the tectonic depression known as the Omi Basin. Of this same type is Suwa-ko, occupying a tectonic basin of the same name. A second type is the lake of volcanic origin. The great majority of these are caldera lakes. These are quite numerous in northeastern Japan and in Hokkaido. Ashi-no-ko in the Hakone caldera is the most famous lake of

this type. Other well-known examples are Tazawa-ko in northern Honshu and Toya-ko, Shikotsu-ko, Akan-ko, and Kutcharo-ko in Hokkaido. Chuzenji-ko, in Nikko and well known to tourists, is also a caldera lake, but has been modified by later down faulting. A third type results from the blocking off of former estuaries by sand bars. Important examples of these are Hamana-ko in the middle Tokai region, Ogarama and Hachiro-gata in Tohoku, and Saromako and Abashiri-ko behind the Sea of Okhotsk shore of Hokkaido.

In addition to these three main types, a number of small lakes have resulted from the damming of valleys by volcanic action or other cause, and there are also a sizable number of crater lakes. The five famous lakes lying just north of Mount Fuji are the result of volcanic damming. Unagi-ike and Kagami-ike (Mirror Lake) in the far south of Kyushu are the best known of the crater lakes. The almost complete absence of glacial lakes reflects the fact that even the high mountains of Japan were scarcely affected during the glacial period—a marked disadvantage in the development of hydroelectricity.

Rivers.—The extremely mountainous character of Japan, the abundant precipitation, and the fact that no drainage divide is far from the sea have resulted in many short, small, and torrential rivers. Only 10 of Japan's rivers have lengths of as much as 125 miles. They are all subject to sudden and violent flood, and flood damage over the years is much heavier than that caused by volcanic action and earthquakes. They are everywhere shallow and, except as they flow over the limited areas of plain, have extremely steep gradients. They are therefore of very limited value for transport, except for the floating of logs in the high-water period. Short and narrow valleys, allowing but limited storage capacity, combined with sudden and sharp alterations in the regimen of river flow, seriously handicap the development of hydroelectric power. The narrow mountain valleys permit only slight development of flood plains, and these are usually subject to inundation. Most such valleys have multiple river terraces, which afford safer sites for settlement and trajectories for communication routes than the present flood plains. As these swift and torrential streams leave the mountains and pass over the littoral plains or through intermontane basins, their flow is rapidly checked and heavy deposition takes place. Nearest the base of the mountains they deposit their coarsest materials and build steeply inclined alluvial fans. Farther on, the depositional materials tend to become finer, and the stream channels markedly broader. The characteristic streambed on the larger plains is very broad and in the dry season carries a braided stream. Deposition continues to be heavy, and with a strong seasonal differentiation of flow the river channels tend to build higher than the surrounding plain. In extreme cases roads and even railroads follow tunnels under the riverbeds. These elevated rivers make irrigation easy, but greatly increase flood damage if the levees give way in times of high water.

Japan's greatest debt to its rivers lies in the fact that virtually all its plains have surfaces of river deposition. This has given Japan its best agricultural land and the great bulk of all its rice land. The same rivers have remained to supply water for irrigation. There is a close correlation between the size of the river and the size

of the alluvial plain with which it is associated. The Tone-gawa, Japan's second largest river, accounts for most of the alluvial surface of the Kanto plain. The Shinanogawa, Japan's longest river, has built and waters the great alluvial plain of Echigo on the Sea of Japan. The three large rivers—the Kiso, the Nagara, and the Ibi—have built the largest continuous area of alluvium, the Nobi or Nagoya plain. The Yodo-gawa crosses the Osaka plain, the Kitakami-gawa built the Sendai plain, and the Chikugo-gawa waters the Tsukushi plain in northwest Kyushu. The Tokachi and Ishikari rivers are associated with Hokkaido's two largest plains, which bear the same names.

Shorelines.—Japan has an exceptionally long shoreline. The roughly 17,000 miles of coast gives to Japan one linear mile of shoreline to each 8.4 square miles of area. This shoreline is not only highly irregular, but also is exceedingly rich in variety and complex in origin. Many types of coastline can be encountered within relatively short distances, and much of Japan's justly famous scenery is found along its coast. If, for example, one follows the Tokaido Railway southwestward from Tokyo for the 77 miles to Numazu, one finds a rich variety of shorelines. First, there is the flattish, muddy deltaic shore of Tokyo Bay. This has been largely reclaimed and is used as sites for industrial plants. Then, along the eastern part of the head of Sagami Bay, extensive stretches of smooth sandy beach are encountered, but the western part is very rocky with narrow coastal terraces inland. Next, narrow sand dunes stretch along the shore of the Sakawa plain. Just southwestward is the Izu Peninsula, where deeply eroded volcanoes reach the sea. As Numazu is approached, a deeply indented coast, formed by the drowning of the margin of a maturely dissected mountain land, occurs. This short stretch of coast from Tokyo to Numazu is not exceptional in its variety, although the Pacific shore is more rugged and varied than that of the Sea of Japan.

In general, the shorelines of Japan fall into two types, sandy and rocky, each of which can be divided into several subtypes. The sandy shoreline occurs where plains, large and small, reach the sea. These characteristically consist of a smooth and sandy beach with a beach ridge in the rear. The shoreline of some sheltered deltaic plains, where wave action is at a minimum, are backed by extensive shore flats. The head of Tokyo Bay, at the mouths of the Sumida and Edo (Yedo) rivers, and the head of Ariake Bay, where the Chikugo River debouches, are of this subtype. The rocky shoreline is found where mountain slopes descend directly into the sea. Where submergence has taken place, the sea's invasion of the erosion valleys results in a highly indented coastline. The best examples of this subtype are found along the coast of the Kii Peninsula facing the Sea of Kumano and along the coast of the southeastern part of the Kitakami mountain land. Another rather common subtype is found where uplift has resulted in a series of coastal terraces backing the present sea cliff. These are commonly associated with the ends of rocky peninsulas, such as the southern parts of the Boso and Kii peninsulas. Much of the Hokkaido coast presents such shorelines, with Cape Erimo as the most spectacular. Cape Muroto in southeast Shikoku is another fine example, as is the Ajigasawa district on the Sea of Japan coast

of northernmost Honshu. The fault-line shore, displaying the present sea cliff without backing terraces, is well represented by the coast running northeastward from Tsuruga. Still another rocky subtype, of which western Kyushu is an example, occurs where uplifted and down-faulted blocks alternate. The former account for peninsulas and island groups, and the latter for bays and inlets. A modification of the rocky shoreline types is found where there is an active development of sand bars producing land-tied islands and bay-mouth bars. Shio-no-misaki at the end of Kii Peninsula is an example of the first, and Cape Miho at the head of Suruga Bay exemplifies the second.

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2. POLITICAL DIVISIONS AND POPULATION.

For purposes of local administration, Japan is divided into 46 primary units, each having considerable autonomy. Most of these units are called *ken*, which is usually translated as prefecture, but there are three kinds of exceptions. The unit which contains the capital and metropolis is known in Japanese as *Tokyo-to*, usually translated as Tokyo Capital Prefecture. (For Tokyo's special status see section on *Government*.) The entire island of Hokkaido constitutes one unit known as *do* (Jap. *dō*). The large cities of Osaka and Kyoto are in units known as *fu*, which is usually translated as city prefecture. This system is referred to as *to-dō-fu-ken*, stated in the order of rank and importance. Table 1 lists the 46 primary political divisions of Japan, their area in square miles, their population as of the census of 1960, and their capital cities.

The system of *ken* or prefectures was adopted in 1871 to replace the system of feudal fiefs. At first Japan was divided into 302 *ken*, but in the same year amalgamation began and the number was reduced to 3 *fu* and 72 *ken*. This trend continued until by 1876 the total stood at 3 *fu* and 35 *ken*. The following years saw considerable readjustment, which resulted in the creation of some new *ken*. By 1888 the present (1963) number of divisions (46) and their boundaries were established, except for the western part of what is now Tokyo-to, which was not annexed until 1892. The aims of the *ken* system, in addition to facilitating local administration, were at least twofold. The first was to break down the spirit of sectionalism, which had developed under the feudal and earlier *kuni*, or provincial, system. The second was to create political divisions with approximately equal resources. The first aim was, on the whole, successfully achieved, although people still like to refer to themselves as residents of an old *kuni* or *daimiate*. The second aim was defeated by the rise of industry, which gave great advantage to some areas and little or none to others. The names of most *ken* were derived from that of their largest city, which became the *ken* capital, such as Kyoto, Osaka, Kagoshima, and Hiroshima. Some *ken*, on the other hand, took their names from that of their most important county, such as Miyagi, Hyogo, and Ishikawa. There were other exceptions as well; Kanagawa took its name from one of the 53 stages of the Tōkaidō (Eastern Sea Road).

Until 1948 the *ken* were administered by governors appointed by the central government in

Table 1—THE PREFECTURES OF JAPAN

Prefecture	Area square miles	Population 1960	Capital
Hokkaido (do)	30,332	5,039,206	Sapporo
Aomori	3,719	1,426,606	Aomori
Iwate	5,882	1,448,517	Morioka
Miyagi	2,808	1,743,195	Sendai
Akita	4,503	1,335,580	Akita
Yamagata	3,602	1,320,664	Yamagata
Fukushima	5,321	2,051,137	Fukushima
Ibaraki	2,352	2,047,024	Mito
Tochigi	2,485	1,513,624	Utsunomiya
Gumma	2,446	1,578,476	Maebashi
Saitama	1,468	2,430,871	Urawa
Chiba	1,954	2,306,010	Chiba
Tokyo (to)	789	9,683,802	Tokyo
Kanagawa	912	3,443,176	Yokohama
Niigata	4,856	2,442,037	Niigata
Toyama	1,644	1,032,614	Toyama
Ishikawa	1,619	973,418	Kanazawa
Fukui	1,646	752,696	Fukui
Yamanashi	1,725	782,062	Kofu
Nagano	5,261	1,981,433	Nagano
Gifu	4,052	1,638,399	Gifu
Shizuoka	2,999	2,756,271	Shizuoka
Aichi	1,963	4,206,313	Nagoya
Mie	2,226	1,485,054	Tsu
Shiga	1,564	842,695	Otsu
Kyoto (fu)	1,784	1,993,403	Kyoto
Osaka (fu)	700	5,504,746	Osaka
Hyogo	3,214	3,906,487	Kobe
Nara	1,426	781,058	Nara
Wakayama	1,822	1,002,191	Wakayama
Tottori	1,347	599,135	Tottori
Shimane	2,558	888,886	Matsue
Okayama	2,720	1,670,454	Okayama
Hiroshima	3,258	2,184,043	Hiroshima
Yamaguchi	2,349	1,602,207	Yamaguchi
Tokushima	1,600	847,274	Tokushima
Kagawa	717	918,867	Takamatsu
Ehime	2,188	1,500,687	Matsuyama
Kochi	2,743	854,595	Kochi
Fukuoka	1,909	4,006,679	Fukuoka
Saga	946	942,874	Saga
Nagasaki	1,574	1,760,421	Nagasaki
Kumamoto	2,870	1,856,192	Kumamoto
Oita	2,446	1,239,655	Oita
Miyazaki	2,988	1,134,590	Miyazaki
Kagoshima	3,013 ¹	1,963,104	Kagoshima
Total	142,300 ¹	93,418,501	

¹ With the restoration of the Amami Islands in 1953, the area of Kagoshima was increased to 3,511 square miles, and that of Japan to 142,798 square miles.

Tokyo, but since that year the *ken* governors must stand for popular election.

The *ken* are divided into secondary political units of three types: (1) *shi*, or city; (2) *machi* (*chō*), or town; (3) *mura* (*son*), or (as generally translated) village. This system is known as *shi-chō-son*, stated in order of rank. These units consistently have had a considerable degree of autonomy. Until 1926 the *gun*, or county, was an intermediate division, but it functioned rather as a detached branch of the *ken* government than as an autonomous unit. Although the *gun* was officially abolished, some offices continued to function under the *gun* name, such as certain agricultural experiment stations. In fact, after considerable inconvenience had been experienced, an office known as the *chihō-jimusho* (local administrative office) was created to perform the functions of the *gun* office for one or more of the old *gun* areas. Both the *shi* and the *machi* involve sizable settlements which have urban functions, but they usually also include country areas of rural settlement. The *shi* is the more important urban settlement and by law must contain 30,000 or more people. It also has much more autonomy than the *machi*.

In the census of 1960 the combined population of all the *shi*, including that of Tokyo-to, was 59,333,171. This was 63.5 percent of that of the entire nation. Although many of the *shi* embrace extensive and well-populated rural areas

if this population were subtracted from the inclusive figures, it would make no important difference in the ratio given above. There are 42 *shi* with populations of over 200,000, and 7 with over one million. The latter are Tokyo, Osaka, Nagoya, Yokohama, Kyoto, Kobe, and Kitakyushu, stated in order of size. The population of Tokyo, which was 6,778,804 in 1940, probably approximated 8 million in the early part of World War II and decreased to probably 2,500,000 after the war, but rose to 4,556,000 by 1949. It was 8,310,027 in 1960. The eighth largest city is Fukuoka, with 647,000 people. Kitakyushu was formed in 1963 out of 5 smaller cities.

The more important of Japan's cities, with 1960 census populations, appear in Table 2.

The distribution of Japan's cities reflects the overall distribution of population as well as that of manufacturing and related industries. Where cities are numerous, the surrounding rural population is dense and, conversely, in regions of low rural densities cities are both scarce and small. Japan's phenomenal industrial growth has accrued primarily to a narrow east-west belt extending from Tokyo through the Tokai, Kinki, and Setouchi regions into northern Kyushu. Here Japan's seven largest cities and a considerable number of its smaller ones are found. It is into

Table 2—POPULATION OF PRINCIPAL JAPANESE CITIES

City	Population 1960	City	Population 1960
Tokyo	8,310,027	Amagasaki	405,955
Osaka	3,011,563	Kumamoto	373,922
Nagoya	1,591,935	Nagasaki	344,153
Yokohama	1,375,710	Sakai	339,863
Kyoto	1,284,818	Hamamatsu	333,009
Kobe	1,113,977	Shizuoka	328,819
Kitakyushu	1,056,381 ¹	Himeji	328,689
Fukuoka	647,122	Niigata	314,528
Kawasaki	632,975	Gifu	304,492
Sapporo	523,839	Kanazawa	298,972
Hiroshima	431,336	Kagoshima	296,003
Sendai	425,272	Yokosuka	287,309

¹ 1963.

these cities that Japan's equally phenomenal population growth has been largely absorbed.

Population.—The problem of population and food supply in Japan has long been chronic. The nation's loss of empire and markets and its strong upsurge in population made the problem more than ever one of stark reality after World War II. During 1949 the increase in population was 1,773,476, the largest of any year in Japanese history. The number of births was 2,724,206, or 33.1 per 1,000; the number of deaths, 950,730, or 11.6 per 1,000. The birth rate, then, was that of the Orient and the death rate approached that of western Europe. Total population in 1960 was 93,418,501.

During the latter half of the Tokugawa period (1603–1867) the population of Japan seems to have remained stationary, probably at about 30,000,000. The estimated figures of the time ranged from 25,000,000 to 27,000,000, but admittedly omitted samurai and outcasts, who together probably totaled 3,000,000. In any event, the first comprehensive estimate, made in 1872 after the Meiji Restoration, indicated a population something in excess of 33,000,000. From that date there was a steady increase, supported by an improved agriculture and absorbed largely into agriculture, until the end of the Sino-Japanese War in 1895. The population in 1897 was estimated at 42,400,000. Especially noteworthy was the

growth of population in the semifrontier lands of Tohoku and southern Kyushu and on the actual frontier of Hokkaido. This was also a period of rapid land reclamation, and there was a healthy, but not spectacular, increase in urban population. After the Sino-Japanese War came the manufacturing industries and a greatly increased production. There was a steady increase in light industrial production until World War I. Particularly pronounced was the increase in urban population and in that of coal mining and sericultural districts. In the older, overcrowded agricultural districts the rural population actually showed some decline, but continued to increase where new opportunities were available. The 50,000,000 mark was exceeded in 1909, and the population reached 54,134,000 by 1917. Following World War I there was a period of industrial vicissitudes lasting for about a decade. Then began a new era of industrial activity, both light and heavy, and a most rapid increase in the size of cities. Rural populations everywhere showed a relative decline and in many areas an absolute loss. By 1927 a total of 61,317,000 was reached; in 1937 the population was 71,253,000, representing an average annual increase for the decade of approximately 1,000,000 people. The rate of increase then began to show a slight decline. The figure for 1940, just before Japan's entry into World War II, was 73,114,000. Between 1937 and 1945, Japan lost about 1,200,000 army and navy personnel, as well as nearly 250,000 civilians by bombing. The figure of 83,199,637 in 1950 represented a rapid increase. In part this was due to the return of Japanese from abroad, but still more to a rising birth rate. The rise after the war was certainly due in large part to the return of millions of young male Japanese to Japan. In 1950, however, the birth rate dropped to 28.2 and in 1951 to 25.6. In 1960 the birth rate dropped to 17.2, and the following year reached a record low of 16.9. It should be noted that the death rate also dropped, to 7.6 in 1960, and 7.4 in 1961.

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3. THE PEOPLE. This section treats Japanese racial and cultural origins, the family, the life cycle, special groups, and cultural patterns.

Racial and Cultural Origins.—The people of contemporary Japan consist of the predominant Japanese and some 15,000 or so Ainu, a people of Caucasoid affiliations found chiefly in northern Japan. Modern Japanese, while basically of Mongoloid stock, are of mixed racial background. The basic Mongoloid traits include black hair and dark brown eyes, tan skin, the Mongoloid spot on infants, and a common occurrence of the epicanthic eye fold (slanting eyes). In addition, Japanese have relatively short legs, giving an average stature of 1.65 meters (five feet five inches) for men and somewhat less for women. They are distinctly roundheaded (cephalic index of 80 and over). The Ainu genetic strain, however, gives many Japanese more body and facial hair than is characteristic of the true Mongol, and another, southern, genetic strain frequently gives wavy hair. This waviness was once a source of misfortune to such Japanese women as were born with it, because the social ideal used to be straight black hair. For a similar reason the

occasional Japanese born with a brownish hair tinge may employ dye rinses to achieve an ideal black.

The origin of the Ainu and of the Japanese people themselves has been the object of considerable archaeological research and is also the subject of Japanese mythology. The full story of the Shintō myth of origin may be found in the *Kojiki*, written in 712 A.D. by imperial order, and in the *Nihon Shoki* (*Nihongi*), written in 720. The myth of origin told in these books retraces the ancestry of the Japanese people to a primeval divine pair, Izanami and Izanagi, who first inhabited the islands which they had formed out of drops of mud from Izanagi's honorable spear. As the original pair, Izanami and Izanagi were at first not certain how to go about getting married and having offspring. When this problem had been settled, numerous offspring were produced, the last being a deity of fire. In giving birth to this being, Izanami was fatally burned and she went to a nether world of death. Izanagi, distraught, sought to follow her, but she warned him not to look upon her in her unclean state of death. He did so nevertheless, and in shame and anger his late spouse sent the old woman of the underworld to chase him. As he fled, Izanagi cast behind him his headdress, which turned to grapes; these the old woman paused to eat. Next he discarded his comb, which turned into bamboo sprouts; these the old woman lingered to uproot and to eat. By such means Izanagi eventually succeeded in escaping. Then when he stopped at a stream to wash away the uncleanness of his contact with death, Amaterasu-ōmikami was born of his left eye. This deity, the Sun Goddess, became the divine ancestress of the Japanese imperial line. Her spirit is honored to this day at the great Shintō shrine at Ise in Mie Prefecture.

This tale of the origins of the Japanese is of interest not only for its importance in Japanese religion, but also because some of the content of the myth indicates affiliation with the east Asian mainland and with the Malayan culture of Formosa and of other Malayan peoples to the south. The account of the first conversations of Izanami and Izanagi and the problem of marriage, for example, is paralleled in the mythology of Formosa and of the islands farther south. The incident in which Izanagi flees from the old woman of the underworld is similar to "magic flight" stories of the Asian mainland and northwestern North America. The evidence of folklore thus indicates two outside cultural influences in early Japan: one from mainland Asia and another from the southern islands.

Archaeological evidence also indicates early cultural influences from more than one area. Prehistoric pit dwellings which have been excavated resemble those of historic tribes in northeast Asia. The contemporary rural dwellings of Japan have a strong architectural resemblance to Malaysian forms, being raised from the ground on piles and having a thatch roof and relatively open sides. These are quite different from the tile-roofed and earthbound dwellings of China. Early pottery types are of forms similar to Korean types. Some of the early jewelry, such as the claw-shaped *magatama*, is made of stones, such as nephrite, not found in Japan.

Not only are the early cultural forms of diverse origin, but the physical types of the Japanese also indicate mixed origins. No Paleolithic finds of man or his culture have been positively iden-

tified in Japan, but early Neolithic finds indicate that one of the most widespread early inhabitants of the islands was a kind of man similar to the Ainu. This type seems to have existed as far south as the Ryukyus. The notable hairiness of the face and body of men of the Ainu type has led many anthropologists to conclude that they are part of an early east Asiatic Caucasoid stock which was later overwhelmed by Mongoloid types. In Japan the latter seem to have come largely via Korea and to have spread gradually northward and southward from Kyushu and western Honshu. Today the Ainu type is found in scattered individuals on Okinawa and as a distinct ethnic group with much of its own culture in Hokkaido. Notable older traits of Ainu culture include a bear festival and sacrifice, tattooing of the lips of women, and garments bearing characteristic broad white line designs on a blue background.

Another early type in parts of Japan was probably of Malayan affiliation. The wavy hair and facial features of many Japanese have parallels among some of the peoples of the Philippines and Indonesia. Some cultural traits of Malayan origin found in traditional Japan included the blackening of teeth as a mark of beauty, the characteristic Japanese house, and the marriage ritual. It is probable that the Malayan traits of the Japanese and their culture and those of the southern regions were diffused from some common area in Southeast Asia rather than that these came to Japan from Indonesia.

In historic times the strongest outside cultural influence has been the Chinese. Certain governmental forms, Confucian philosophy, and Buddhism, as well as the arts of painting and sculpture associated with Buddhism, are notable influences.

While the Japanese are thus of mixed racial background and their cultural origins come from diverse mainland sources, they have developed, like the British, as an insular nation and have created their own characteristic culture. Nor is Japanese culture restricted to combinations of borrowed elements. Some distinctive Japanese cultural inventions include the deep hot bath and the whole complex of behavior surrounding it, the characteristic alternating 5-7-7 syllable, non-rhyming lines of the Japanese poetic form, and the delicate light paper used for multitudinous purposes long before the people of the West had heard of Kleenex. Japan has also contributed her share in religious development, Shinshū and Nichiren being distinctive Japanese sects of Buddhism, and the characteristic forms and deities of Shintō being peculiar to Japan. (See section on *Religion*.)

Family and Household.—The primary social unit of Japanese society is the household consisting of a family, an occasional other relative, and, if the family is well to do, one or more servants. The size of a community is usually calculated not in individuals but in households, and many local civic duties are reckoned in terms of days' work per household rather than per individual.

The basic kinship group in Japanese society, as in all societies, is the family. It differs, however, from the family in the United States in composition and in the social roles of its constituent members. Members of a Japanese family include the head of the house and his wife, the eldest son (by birth or adoption) and any of his children, and any unmarried children of the



Above: The torii, a traditional and symbolic gateway built at the approach to a Shinto temple.

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Right: At Mt. Koya in southern Honshu, a tree-lined pathway leads to the inner recesses of a historic place of worship for members of the Shingon Buddhist sect.

Below: Flower arrangement is an art as well as a tradition in the Japanese home.

(Top left) Philip Gendreau; (all others) Consulate General of Japan



Below: During the winter season, skiing enthusiasts on the island of Honshu take to the snow-covered slopes in mountainous districts facing the Sea of Japan.





Above: A Japanese woman inspects an electric washing machine. Electric appliances comprise one of Japan's most thriving industries.

Below: On display are diesel-powered buses made in Japan for export.



Above: The day starts with early morning prayers at the school for Buddhist nuns in Koide, a town in the Prefecture of Niigata.

JAPAN

Left: A nurse by profession, this young lady at home preserves an ancient Japanese tradition by performing the tea ceremony.

(Top) Black Star Pan-Asia Photo; (center left) Peter Schmid from Pix, Inc.; (others) Consulate General of Japan, N.Y.

master and his wife. The family thus can comprise two marriage units or elementary families. This kin group lives together in a single household. Sometimes there are also living as part of the family a grandfather and grandmother who have retired. This means that the old man has surrendered to his son the headship of the family and the responsibility for household affairs.

A larger kinship unit is also recognized in the form of the extended family, comprising not only the brothers and sisters of the male side of the immediate family, but also any of the master's children who may have married or have been adopted by others or have established branch families. This extended family comes together for weddings and funerals. They help one another in certain agricultural work, and the older members form a family council for reaching important decisions concerning the family welfare, such as buying or selling land or arranging a marriage. In family dwellings servants also form part of the household. The manservant or maidservant in the house usually comes from one of the less well-to-do families in rural areas and may even be a nephew or niece of the master or his wife. Servants are usually hired by the year and are treated as part of the family in work and at meals.

The social position of the master of the house is reflected in the fact that he takes the first bath, receives the first food, and is responsible for taking care of the income of the family. At the same time he is responsible for the family welfare. He represents the family in its dealings with the government and with other external institutions. While the head has ultimate financial responsibility, the wife generally manages the internal economy of the household, covering such matters as the purchase of food and of clothes for the family and for the servants. Japanese women by tradition also play an important part in family affairs. For example, the older women make most of the preliminary family arrangements leading to a marriage and conduct the necessary preparations for funeral and memorial services. Informal education of the children also in large part falls to the mother.

The custom of adoption is widespread in Japan. One of its important social functions is that of preserving the continuity of the family and of the family name when there is no heir. Japanese also have a great fondness for children, and a childless couple is likely to adopt a child quite apart from the consideration of the family name. There are a number of forms of adoption, including adopting a son if one has no children, adopting a husband for one's daughter if one has no son, and adopting a younger brother as a son. Adoptions, like marriages, must be recorded and also can be legally dissolved. In general, an adopted son has both the rights and the duties of a real son.

The Japanese place considerable emphasis on age status. This is reflected in the fact that in Japanese one refers to "older sister" or "younger sister," not just "sister" or "brother." Similarly, the oldest son has more privileges and also more responsibilities than a second or third son (it is usually second or third sons who are adopted by other families, whereas a first son is expected to continue the family line). A corollary of this emphasis on relative age is the closeness of coeval neighbors or classmates.

Life Cycle.—In the course of the lifetime of

a Japanese, a number of important events mark changes in his social status in his family and community. These include the rites of passage related to birth, marriage, and death common to so many societies.

Birth.—In most of Japan midwives rather than physicians assist the mother. A few days after the birth there is a naming ceremony, to which are invited the midwife and a few relatives and close friends, all of whom bring gifts for the new baby. Special birth ceremony cakes are served at this time. The details of the naming ceremony vary from region to region, but the essential gathering which serves to introduce the newborn child to the immediate family and to the neighborhood group is universal. Since the child is small and may die before reaching adulthood, he has as yet little social personality, a fact which is reflected in the smallness of the gathering at a naming ceremony.

Hiaki.—At 31 days after birth if a boy or 33 if a girl, *hiaki* is observed. The child is taken to visit the deities at the village Shintō shrine, where a brief ritual is performed by the priest. This serves to introduce the child to the village gods and marks the end of an initial stage in the child's life. At this time the mother is also relieved of a number of restrictions concerning food and now may cross water and may resume ordinary house or farm work. *Hiaki* marks the end of a period of anxiety and uncertainty as to the survival of the child.

Early Training.—A Japanese child is usually nursed until another is born. It is taught early to value cleanliness. The young child, especially if a boy, is a favored person and is rarely subjected to physical punishment. With the birth of the next child, the erstwhile youngest loses the center of attention and is put in care of a less attentive brother or sister or nurse. He soon adjusts to his new position and joins the young age group of two and three year olds of his neighborhood.

Children learn both the physical and the social differentiation between boys and girls early in life. In general, in teaching the young child proper behavior the sanctions of praise and ridicule are strongest and resort to physical punishment is not ordinarily made.

The earliest and closest ties of a child are with his mother, who feeds and bathes him and sleeps next to him at night. Thus is formed between child and mother a strong sentimental bond which may persist through life despite the many traditional restrictions placed upon it in Japanese society. Even an adult man may heed an old mother's advice.

Marriage.—Traditionally marriages in Japan are matters of arrangement between two families of similar social class. The first step is for a "chance" meeting to be arranged between the two principals. After such a meeting their feelings are sounded and, if there are no serious objections, further negotiations may be undertaken. One aim of such an early casual meeting is that, in the event that either side objects to the proceedings, the engagement may be canceled before it becomes public knowledge and neither family need lose face.

After these preliminaries a family friend, who is chosen partly for his social standing, will be invited to act as go-between. Since marriage arrangements involve investigations of delicate matters in family history, such as leprosy, tuber-

culosis, and police records, it is easy to see the need for an intermediary in order to avoid direct face-to-face embarrassment between the families concerned.

If all goes well, the next step may be a formal betrothal exchange (*yuinō*) between the two families, but this is not typical of the average farm family. When the marriage date has been set, partly on the basis of astrology and partly on general convenience (it usually takes place in the fall), the groom's family prepares the house to receive the bride, installing new screens, refurbishing the kitchen, and the like, while the family of the bride prepares the wedding clothes and purchases such wedding gifts as a chest of drawers.

On the day of the wedding the bride, accompanied by her relatives, goes to the groom's home, where the ceremony of *sansan-kudo* is held. This is a formal exchange of sake (rice wine) between the immediate relatives, the marriage broker and his wife, and the bride and groom. Then the wedding banquet takes place, after the bride's relatives, seated on one side of the room, have been introduced to the groom's relatives, seated on the other. On the second day there is another banquet given by the groom's family to introduce the bride to the important people of the community, such as the mayor or the village headman and the schoolmaster; and on the third day there is a lesser, but nonetheless gay, party to introduce the bride to the women of her neighborhood. A wedding is usually a high point in the life of a household and may involve considerable expense.

The marriage often is not formally registered until some time after the social event. If the marriage should prove unsuccessful during this intermediate period and the principals separate, there is thus no record whatsoever that a marriage has taken place. In general, if a child is expected, the marriage will be registered to ensure its legitimacy. The birth of a child tends to consolidate a marriage and improve the social position of the wife in her new family.

A few days after the ceremony the bride and groom make a ceremonial visit, bearing gifts, to the go-between. He continues his responsibilities for the marriage and may be consulted in the event of marital disagreements and invited to any important events in the family, such as naming ceremonies and funerals.

Since World War II there has been some increase in the number of marriages which result from free choice on the part of the individuals concerned, but even under these conditions a go-between is often used for form's sake and to arrange the actual marriage ceremony.

Retirement.—When a person reaches the age of 60, he is likely to retire, surrendering the responsibilities of family and household to his eldest son. There is sometimes a small party of a few relatives and friends to celebrate a man's attaining this age. In a sense he has achieved a second childhood and again may wear red underclothes and may speak freely without being called to account. In rural Japanese society it is the young ladies who are prim and proper and the old women who may do and say what they please.

Death.—The final event of the life cycle is death. The neighbors come together to console the bereaved and to assist in funeral preparations, while the relatives meet to mourn. The funeral itself, however, does not mark the end of a man's social life, inasmuch as it is followed by a series

of memorial services, which begin the day after death. In Japan the death day of a famous man is as likely to be celebrated as his birthday and he is also likely to be known by a posthumous name, as are the Emperor Jimmu and the great Buddhist leader and scholar Kōbō Daishi.

There are seven memorial services marking the first seven weeks following death. The last of the seven (on the 49th day) is *hiaki* and represents the end of the heavy mourning period, after which a number of mourning taboos may be lifted. (This is similar to *hiaki* following birth.) There are then yearly memorial services at traditional intervals for 100 years. Most ordinary families rarely observe these memorial services beyond the 50th year, and for women and children the last memorial service may fall considerably short of this interval. Traditionally, Japanese funeral and memorial services are performed by Buddhist priests.

It may be noted that in all the celebrations associated with birth, marriage, and death there is an intermediary present—the midwife, the go-between, the priest—and that he sits in the place of honor at the banquet. It also may be noted that there is a banquet for kin associated with these events and that the size of the social gathering varies in accordance with the social importance of the event or of the person for whom the ceremony is held.

Special Groups.—In Japan there are several special categories or groups of people whose status, until comparatively recent years, was defined by law and who, even today, continue to occupy a special position by force of custom and public opinion.

Eta.—In pre-Meiji Japan, the eta, or pariah class, ranked below the social classes of warrior, farmer, artisan, and merchant. The eta performed tasks considered menial and unclean, such as those of slaughterers, tanners, and executioners. Although these distinctions were legally abolished during the Meiji period (1868-1912), the traditional prejudices against the million or more people descended from this class persist to this day. The term eta is not a polite one and today the term *suiheisha* (water level, that is, equal) is preferred. Other Japanese ordinarily will not intermarry with *suiheisha*, and they frown upon the rise of people of this origin in the social or political hierarchy. Their economic position has not changed greatly, and many remain as tanners, shoemakers, butchers, tenant farmers, peddlers, and day laborers. The people organized themselves into the Suiheisha Undō (Water-Level, or Equalization, Movement) for their social betterment in the 1920's and succeeded in forcing greater recognition of their civil rights. The organization aroused such hostile public sentiment by its militant and terrorist tactics that during the crisis of World War II the movement was largely suppressed.

Geisha.—The geisha are entertainment girls, who dance, serve drinks, and provide light company at a banquet in the tradition of the court ladies of old Japan. The geisha undergoes an apprenticeship and is licensed by the police. Strictly speaking, she is not a prostitute (*jorō*). The geisha's entertainment is by no means innocent, however, and her jokes often carry double meanings. The geisha provides glamorous sex appeal, which middle- and upper-class Japanese men do not expect from their wives. Since World War II the careful training of the geisha in the

art of song and dance has declined and some of her traditional functions have been assumed by cabaret girls and others.

Women.—Traditionally the Japanese woman was supposed to be the loving and respectful servant first of her father, then of her husband, and finally of her son. Until the Allied occupation of Japan the principle of the inequality of the sexes was also embodied in the civil code, in such matters as property, inheritance, and divorce. The culture demanded that the woman be dutiful, patient, and good natured. The career woman was rare.

In actual fact, however, the Japanese woman did not occupy so inferior a position as was generally believed. A distinction must be drawn between women in the upper and middle classes and women of the farming and poorer classes. Among the latter, numerically more significant than the former, the woman was in many ways the social equal of the man, partly due to the greater economic interdependence of the sexes and partly due to the fact that the Confucian traditions of woman's inferior status were less firmly entrenched among them. Lower-class women are much freer in speech and gesture than their middle- or upper-class sisters. Even the higher-class woman had certain advantages of social and psychological security. She could be reasonably sure that her husband's affair with a geisha would not interfere with his family obligations and thus break up the home. In the event of widowhood her husband's family would look after her.

Since the Allied occupation a number of legal changes, giving women the vote and greater rights in initiating a divorce, have been made. It is doubtful, however, if the actual social changes are as great as the legal changes indicate, partly because women in Japan have never been so unimportant in the family as many foreigners have thought and partly because social changes are rarely so dramatic as legal changes.

Cultural Patterns.—A cultural pattern is a traditional mode of behavior characteristic of the members of a particular society. Every society is characterized by its own peculiar texture of such patterns of behavior on the part of its constituent members. In Japan, for instance, when greeting one another people bow, whereas in the United States they shake hands. This reflects a general Oriental pattern of culture whereby bodily contact between the sexes in public is bad form. In this subsection six predominant cultural patterns of Japanese society are outlined:

(1) The pattern of group action and group responsibility rather than individual action and individual responsibility.

(2) The pattern of avoidance of face-to-face relations of embarrassment.

(3) The pattern of loyalty and group solidarity.

(4) The pattern of self-discipline and the attainment of success against great odds.

(5) The pattern of ritual cleanliness.

(6) The pattern of ceremonial suicide.

Group Action and Group Responsibility.—Throughout Japanese society from the central government to village communities stress is laid on the group rather than on the individual.

Although the Japanese Cabinet, including the prime minister, reaches its decisions as a result of discussion and compromise, the final decision is published as unanimous. No vote is taken on an

issue, and no majority and minority reports are made. It is considered more important to achieve a unanimous decision by compromise; if this cannot be done, dissenting members may resign.

In rural areas the village councils, when discussing policy with the village headman, come to a group decision in the same manner. A headman or mayor would never think of pursuing any policy without the agreement of his council.

Associated with group responsibility is a pattern of rotating responsibility. In village affairs the hamlet head changes annually, and a local god house (*dō*) is tended by a different group of neighbors (*kumi*) each year. In the national government no one man is prominent as the responsible leader for a long time—different leaders appear as prime minister, but none becomes a permanent officeholder.

Avoidance of Face-to-Face Relations of Embarrassment.—This involves the concept of face—personal self-respect and prestige—so important in the Orient. To disagree point-blank with a person over a cup of tea would be rude in the highest degree—hence the tendency for polite agreement with most comments even though they be inconsistent one with another. On more important matters, such as marriage or a business deal, where some disagreement is inevitable, embarrassing face-to-face relations are avoided by means of a third party or go-between.

A marriage, which is primarily a social and economic relationship between two families, involves, as already shown, much careful investigation of familial backgrounds, and such investigations, if made directly, easily could lead to embarrassment and loss of face by one or another of the families concerned. This is avoided by a go-between, who serves to maintain relations between the families during the critical period.

Since in business dealings direct bargaining would be unseemly, Japanese prefer to employ the services of a broker or business go-between, who may receive a commission from both parties for his services—from the one for getting a high price, from the other for reducing the price.

In the employment of servants it is usually best to work through an intermediary in Japan. And a servant is likely to resign on a moment's notice if his employer causes him to lose face by openly accusing him of some error before other persons. For a servant to tell his master that he is resigning because he does not like the work or because he has an offer of a better job elsewhere, would be to cause loss of face to his employer. So he may give illness as the cause of his no longer working. The wise employer will understand and either will search for another servant or will offer to raise the wages.

Group Solidarity and Loyalty.—The Japanese emphasis on group solidarity involves the duty of loyalty to one's group, so that the individual will traditionally defend the interests of his employer, of his family, and of any other group of which he is an active member. The Japanese government and army of prior days, for example, stressed loyalty to the nation through personal loyalty to the emperor as the supreme duty of all Japanese citizens. The most famous of Japanese historical dramas, *The Forty-seven Rōnin*, is a tale of great personal loyalty to the memory of a feudal lord.

A corollary to these two traditional behavior patterns in Japanese society—group responsibility and face saving—is that an individualist is re-

garded as selfish and antisocial. The democracy of the United States was regarded before World War II by many Japanese as a society full of stress and strain because of its many members who—to the Japanese way of thinking—regarded their own individual welfare to be more important than that of their family or of their country.

These concepts of loyalty, group action, and avoidance of face-to-face embarrassment have developed in Japan as a result of two factors: (1) a long national history, especially the 250-year period of feudalism and peace which ended in the 19th century; and (2) the influence of Confucian ethics on Japanese thought.

The concept of rugged individualism found in the United States comes from the frontier and pioneer tradition of a newly settled nation. Japan, by way of contrast, has a long cultural history during which traditional patterns of social relations became stabilized. In such a society an individualist or a man who acts in an unexpected manner is criticized as upsetting social equilibrium.

Self-Discipline and Attainment of Success Against Great Odds.—Every year on May 5 there is a special festival in Japan to honor boys, at which time large paper carps are flown from poles. The carp, a fish which swims upstream and which does not wriggle when laid on the chopping block, is the traditional ideal of Japanese manhood.

In this ideal the societies of Japan and the United States come somewhat closer than in the first three national traditions. The Japanese schoolboy, for instance, is taught the story of how Abraham Lincoln rose to greatness from humble beginnings and how he walked for miles to borrow a book. Many Japanese heroes are men who rose to greatness by hard work and from humble beginnings.

Associated with the ideal of achieving great ends by overcoming handicaps is the Japanese ideal of frugality and self-discipline. This is perhaps a reflection of the frugality of Japanese daily life in homes with little in the way of material comforts. Zen Buddhism, popular in Japan, stresses mental discipline. In the Japanese Army, which was Spartan in all its phases, the conscript was soon taught the virtues of an even greater self-discipline and frugality than he had experienced in his civilian life.

Ritual Cleanliness.—When arriving at a Japanese inn or home, the guest must remove his shoes before entering and soon after arrival is expected to bathe. Almost everyone in Japan—even a poor worker or a rural peasant—takes a daily bath. The deep Japanese bath, incidentally, is a purely Japanese development different from anything in the rest of Asia or the West.

A small infant soon learns to respect cleanliness and to avoid dirt, so that all a mother need say to her child to make him drop something is that it is dirty.

The ritual aspect of this Japanese emphasis on cleanliness is seen in the sharp contrast between custom in regard to a Japanese house or temple and that in regard to Western-style buildings in Japan. In a Japanese home or inn or temple, where one removes footgear, the interiors are spotless; but in a train or a railway station, where one does not remove one's footgear, the floor may be littered with trash.

The whole basis of Shintō ritual is one of cleansing one's self—body and soul. Before enter-

ing a Shintō shrine one must wash one's hands and rinse one's mouth. Before the priestly ceremony begins, each participant presents a sacred branch at the altar as a symbol of a pure and sincere soul.

Ceremonial Suicide.—In Japan there is no religious sanction against suicide, which is not considered a sign of moral weakness or degradation. On the contrary, there are circumstances under which the courage to take one's own life is essential to the honor of the family name. In feudal times a sentence of self-destruction (*seppuku*, or harakiri) was considered more honorable than that of death at the hands of an executioner. Wives of samurai (gentry or lesser nobility of military vocation in the former feudal system) had as part of their dress a short dagger with which they could commit suicide in the event of a threat of personal dishonor. As is well known, Japanese soldiers were told that the only honorable course in the face of defeat and capture was suicide.

A man who regards himself as responsible for some tragic error may commit suicide. There have been cases of police officials who have committed suicide as the result of a relatively minor confusion in regard to arrangements for the emperor's progress through the area of their jurisdiction.

Another motive for suicide is that of protest. A man who feels some act to be very wrong, but who sees no way of changing it, may commit suicide at the doorstep of the man whom he holds responsible, that he may draw attention to the wrong. Such a suicide occurred before the American Embassy in Tokyo when the Immigration Act of 1924, which excluded Japanese, was passed by the United States Congress. This type of suicide is intended to embarrass the person against whom the protest is made.

Still another form of suicide is the rather mystical one involving a desire to follow in death some beloved leader. The most famous modern example of this was when General Maresuke Nogi and his wife took their lives after the death of Emperor Meiji in 1912.

In all these types of suicide it is clear that the individual must have considerable will power and be in a state of high rather than low morale. These are not the acts of men at the end of a downward moral course. In peacetime, however, none of these forms of suicide is common. Most suicides in Japan are prosaic self-dispatching as the result of poverty or of some social or moral impasse, such as the joint suicide of a young couple whose parents will not countenance their marriage. The suicide rate for Japan in the 1930's was just a little above that of the United States and below that of France.

In the physical or material culture of the Japanese there are also a number of characteristic patterns. For example, in the domestic architecture the low, horizontal line is stressed, giving to the interior of a Japanese-style house or inn a restful, aesthetic effect. Smallness of art objects is another characteristic trait. Japanese craftsmen have elaborated on small and carefully worked objects such as the netsuke. These matters are discussed in more detail in the sections on *The Fine Arts and Architecture*.

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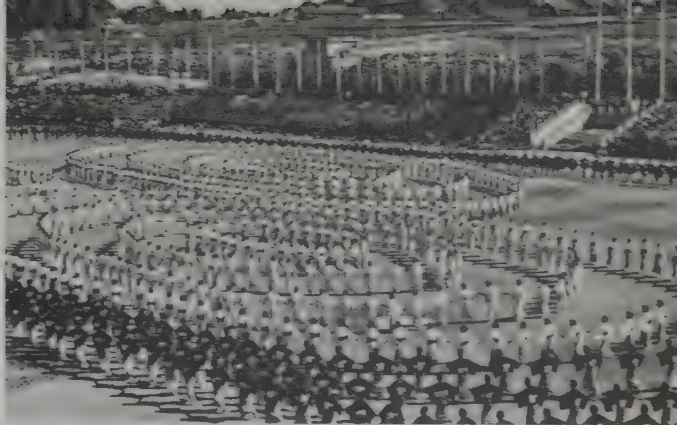
Above: This little girl, wielding a rather large brush, is a hopeful competitor in her school's annual calligraphy contest.

JAPAN

Below: This very modern school, complete with Western-type playground, caters to the needs of younger students.



Right: Archery is one of the ancient and martial Japanese sports which have survived in their traditional form.



Above: The spectacle of traditional folk dances presented en masse by hundreds of housewives, is a recent and popular innovation in Japan.

Below: Painting class at Mukogawa Women's Academy, southern Honshu. Here girls are taught many subjects that fit them for modern living.





Top left: Kobe, a busy Japanese seaport, lies at the foot of the Rokko Mountains.

Top right: Tokyo's modern hotels have both Western- and Japanese-style accommodations.

JAPAN

Left: Kimono-clad shopper and uniformed department store service girls epitomize the contrast between old and new.



(Top left) Rapho-Guillumette; *(top right and center)* Black Star Pan-Asia Photos; *(bottom left)* Consulate General of Japan, N.Y.; *(bottom right)* Ewing Galloway



Above: A modern Hiroshima has replaced the city destroyed in 1945 by an atom bomb.

Left: The gay Tanabata, Festival of Stars, celebrates a mythological meeting of lovers.

(New York 1945); Benedict, Ruth, *The Chrysanthemum and the Sword* (New York 1946).

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4. NATURAL RESOURCES. In this section are discussed the following resources: food, forest, mineral, fiber, fuel and power. That each of these overlaps with the others illustrates the complexity of the use of natural resources in all save the most primitive societies.

Japan proper—the islands of Honshu, Hokkaido, Kyushu, and Shikoku, together with nearby islands and the Ryukyus north of latitude of 27° N.—covers an area of 142,798 square miles. The estimated population of the country on Dec. 1, 1953 was 87,200,000. The pre-World War II area and population of Japan were much greater, since Formosa (Taiwan), the Kwantung Leased Territory, Korea, Karafuto (southern Sakhalin Island), the Kuril Islands, Okinawa, and the former mandated islands of the Western Pacific were then included. Although the empire, including Manchuria as well as the above-named territories, was far from being self-sufficient, it was relatively so at least in terms of food, and many strategic raw materials also were supplied in large quantities.

Japan is poorly endowed with natural resources from any standpoint, but it is unwise to attempt an analysis of her resource position without taking into account the markedly lower Japanese living standards as compared with United States standards. The following evaluation of resources is geared to Japanese standards.

Food Resources.—The qualities of the land and of the seas immediately adjacent to the land determine in large part the nature and quantity of food domestically available to any country. Topographically, Japan is a land of steep slopes and mountains with relatively small lowlands interrupting the dominant mountain structures. Furthermore, considerable areas of lowland are not cultivable for reasons of poor drainage or competing land uses. Thus, of the 91.4 million acres of land surface in Japan, only some 16 per cent is arable. Most of this land is in the lowland areas, of which the largest is the Kanto plain on the middle east coast of Honshu (3.2 million acres). Other major lowlands are the Ishikari plain in Hokkaido (.5 million acres), the Echigo in northwestern Honshu (.45 million acres), the Nobi on Honshu near Nagoya (.45 million acres), the Sendai along the northeastern Honshu coast (.37 million acres), the Settsu near Osaka (.31 million acres), and the Tsukushi in northern Kyushu (.30 million acres). All these lowlands are along the coast, and each contains a major urban center or centers. In addition, there are numerous smaller mountain basins on each of the major islands.

Climatically, Japan is better favored. No portion of the country can be said to be deficient in rainfall, although seasonal droughts occur, especially in the Inland Sea area, which with 40 inches of rainfall is the driest region. Japan's position on the eastern margin of Asia places it well within the monsoon realm, and the summer monsoon, the season of maximum rainfall, coincides with the growing season. At the same time, some areas (especially on the Japan Sea coast) suffer from excessive winter rainfall, and floods are not uncommon. In terms of climate in general and

temperature in particular, Japan proper, stretching from 27° to 45° 50' north latitude, resembles the southern and eastern coasts of the United States. Temperatures permit two crops a year in much of the country south of 37°, and the arable land surface can be increased substantially by this means. Indeed, 30 per cent of the cultivated land in Japan is double cropped. In Hokkaido, however, the climate resembles that of New England; severe winters and a relatively short growing season prohibit double cropping.

Japanese soils may be divided into two types: the irrigated and the dry. By and large, the irrigated soils are alluvial in origin, and alluvium accounts for about 15 per cent of Japan's surface area. Yet, not all alluvial soils are capable of agricultural use for reasons of drainage, slope (on terrace margins), or alternative uses chiefly in connection with urban occupancy. The irrigated soils are compact, uniform, and deep, but centuries of intensive use and monocultural practices have reduced their fertility to a point where constant fertilizing is necessary. Excess water percolating below the surface and constant puddling have led to a leaching of the upper horizon (essentially only one rather than several horizons as in nonirrigated soils) and to the formation of an impervious hardpan below the surface which further impedes drainage on level land. The dry soils are chiefly mountain and hill soils, thin and relatively infertile, though formed from a variety of parent materials. In the far north are found true podzols or forest soils; farther south these tend to become gray and brown podzolics; and in the south red and yellow podzolics with lateritic qualities predominant. Also common are the so-called *ando* soils, found only in Japan, which generally have developed over acid volcanic materials and are infertile. Some of the dry soils, however, are in the lowlands on terraces or gentle slopes. These are alluvial in origin and generally quite fertile, having been improved somewhat, as compared with most Japanese soils, over their natural state.

Associated with soils is the problem of drainage. The generally abundant rainfall characteristic of Japan is conducive to rapid soil erosion on cultivated or cleared slopes. Irrigated land, though little disturbed by erosion, is subject to frequent flash floods and to almost universal poor drainage. It is estimated that 40 per cent of the land under irrigation cannot grow a second crop, even when climatically feasible, because of inadequate drainage. Along the coasts land reclaimed from the sea and former lagoons is subject to flooding during storms and periods of strong on-shore winds.

In the light of this complex of natural conditions, it is not strange that Japanese agriculture, the basis of livelihood for almost half of the population, is compressed into valleys and lowlands, where high production is maintained by an unparalleled expenditure of human effort and by the liberal application of fertilizers. Where level land has not been available, there has been either an upsurge along the slopes of valleys and lowlands and the laborious creation of artificial terraces, or the clearance of forest slopes where soils are thin and easily eroded. Farm units are small, averaging 2.5 acres in 1954, but two thirds are even smaller. Holdings are scattered, and plots are separated from each other by ridges which serve both as property boundaries and as dikes to hold the irrigation water.

Agricultural patterns and production vary with climatic, topographic, and edaphic conditions. The characteristic pattern, however, is one of paddy cultivation on flats and level terraces, with other grains, tubers, and vegetables on the higher ground where water for irrigation is not available. Rice is grown throughout Japan, but in lesser quantities in Hokkaido and northern Honshu, where the growing season is short. In these areas wheat, oats, millet, buckwheat, and corn predominate, and pasture land, which is of negligible importance in central and southern Japan, becomes of some significance. Livestock raising is of small importance except in Hokkaido, where pasture is available, and animal products are of minor importance in the food consumption patterns of Japan as a whole. A corollary of this condition is a general shortage of hides and skins for use as leather.

The possibilities for enlarging the cultivated area appear to be few. In 1948, 3.8 million acres were considered capable of reclamation for agriculture. At the end of 1951 over 1 million acres had been reclaimed, chiefly former military lands and airfields. The remainder is submarginal land which may be too costly to reclaim—undrained lakes, marshes, and coastal lagoons, gentle slopes now in brush, fuel-wood scrub in cultivated areas, and grazing land. On the other hand, improvements in drainage of paddy fields could add another 15 per cent to the producing acreage, while the consolidation of field plots through the rearrangement of property holdings might also contribute substantial acreages.

The waters surrounding Japan are a rich source of sea food, the chief domestic source of protein in the Japanese diet. Almost the entire coast is dotted with small fishing villages, and the fishing industry employs close to a million men. The warm Japan Current (Kuroshio), which sweeps northeastward along the southeastern coasts of the country, has temperatures ranging from 68°F. in late winter to 80.1°F. in late summer, and in its waters are found an abundance of fish—sardines (most important of Japan's marine products in volume), mackerel, tuna, bonito, skipjack, albacore, and sea breams. Where the Japan Current meets the cold Okhotsk or Kuril Current (Oyashio) off the northeastern coast of Honshu, there is a zone of mixing, in which both cold- and warm-water fish are found. The waters of the Okhotsk Current, which seldom exceed 64.9°F., harbor herring, salmon, cod, and crab. Both the warm and cold waters also produce large quantities of edible seaweed.

It is estimated that in the period 1935–1940 over 75 per cent of Japan's sea food landings came from waters within 20 miles of Japan proper, exclusive of the colonial sources of supply. Before World War II, Japanese fishermen operated also in far distant waters. In all, over 7 million tons of fish and other sea food were harvested annually. After the war, however, Japan's fishing activities were restricted by Allied agreement to an area bounded on the east by the 165th meridian of east longitude (extended in 1949 to the international date line); on the south by the Tropic of Capricorn; on the north by a line which separates Hokkaido from Sakhalin and the Kurils; and on the west by a line which divides the Sea of Japan in two, cuts through Korea Strait and the East China Sea, and separates the Ryukyus from Formosa. Fish landings primarily from this area, but including

special whaling expeditions to Antarctic waters, totaled 4.2 million short tons in 1951. In 1952, however, the areal restrictions were removed, and fish landings totaled 5.2 million tons.

The possibilities for expanding the annual production of sea foods, both animal and plant, in the postwar period are few. There is evidence that since 1920 overfishing has resulted in a gradual depletion of fisheries resources. As a corollary, fish formerly used for fertilizer are being used for food. As a result of the war, Japan lost the right to fish in northern waters from which much of her highest-quality sea food came—crab, salmon, agar-agar. These were important prewar export products.

Despite the intense utilization of the resources of domestic agriculture and fisheries the Japanese are unable to provide food in sufficient quantity to maintain health. Japan in 1953 produced enough food for only 80 per cent of her population at a standard of 2,250 calories and 70 grams of protein daily. Even if some future increases in the production of food are registered, it is expected that they will be countered by increases in population. See also section on *Agriculture*.

Forest Resources.—More than one half of Japan is forested: 55 million acres of a total of 91.4 million. Of these 55 million acres, 50 per cent are in broad-leaved forest, 29 per cent in conifers, and 21 per cent in mixed forest. Less than 0.5 per cent is in bamboo, a giant grass growing in groves much like tree forest. In addition there are about 6 million acres of brush (*gen-ya*). There are three general forest zones: (1) the boreal zone in northern and eastern Hokkaido and on elevation outliers in Honshu, which is composed of spruce, fir, larch, and birch; (2) the great mixed forest zones, which cover much of Honshu to points south of the latitude of Tokyo and contain both deciduous broad-leaved species—beech, ash, chestnut, poplar, and oak—and natural and planted stands of conifers—chiefly pines, cryptomeria, firs, and cedar; and (3) the southern forests of broad-leaved evergreens and deciduous trees, of which oaks are most important. About 60 per cent of the mixed forests are coppice and fuel-wood stands unsuitable for the production of construction timber. Furthermore, about 6 million acres of forest were still inaccessible in 1954 because of lack of transportation. In 1952 production of wood totaled 1,829 million cubic feet, or slightly below the prewar average and well below the record production of 3,300 million cubic feet set in 1943. Fuel wood accounts for half of the total; before the war, however, it accounted for closer to two thirds of all production.

The importance of wood and wood products in Japan cannot be minimized. With the exception of public buildings and the homes of the wealthy, most of the buildings in Japan are made of wood. Wooden utensils are used wherever possible instead of metal implements. Wood cellulose is used, of course, for the manufacture of paper and rayon, and Japan was sixth among the nations of the world before World War II in the production of wood pulp. Furthermore, the Japanese rely heavily on wood rather than coal for fuel; charcoal is the common heating and cooking fuel in the Japanese household, and charcoal gas provides fuel for a substantial percentage of the motor vehicles. On the other hand, the importance of forests to the stabilization of soils and water resources is immeasurable, and care

must be taken to avoid overcutting and the resultant economic penalties of erosion and floods, which already have been evidenced.

The estimated needs for wood of all kinds—lumber, pulp, fuel, and general manufacturing—at the 1930–1934 level of consumption come to 2.6 billion cubic feet a year of which 1.6 billion cubic feet is for fuel. The growth rate for accessible forests, however, is estimated at some 1.68 billion cubic feet annually, leaving a deficit of around 900 million cubic feet. Before the war Japan, an exporter of both timber and pulp products, imported almost one third of her pulp and a substantial percentage of her lumber from Karafuto. Tropical hardwoods came from Southeast Asia, and some 10 per cent of her softwood production and 30 per cent of the pulp consumed were imported from western North America and the Scandinavian countries. Without these outside sources of supply, Japan cannot be expected to supply her domestic timber needs, let alone exports for markets abroad, without depleting her forest resources.

At the same time, some possibilities exist for the increased and economical exploitation of forest resources. Tapping of existing "inaccessible" forests would make available 146 million cubic feet of wood a year. The placing of marginal agricultural lands into productive forests is a long-range possibility, as are improvements in, and expansion of, reforestation in cut-over areas. In addition, more selective cutting practices at less frequent intervals would eventually provide larger timbers and help prevent the serious soil erosion which is encouraged by present clean-cutting practices. On the debit side, however, is the probability that demand will increase far above 1930–1934 levels as population increases and industrialization continues.

Mineral Resources.—The Japanese islands possess a great variety of mineral resources, few of which, unfortunately, are in sufficient quantity to supply Japan's normal peacetime needs.

Metals.—The variety of metals is especially extensive. Of the 33 metallic minerals used in industry, Japan is supplied to some extent with 22, but only 6—chromite, copper, gold, magnesium, silver, and zinc—are present in sufficient quantity to meet minimum domestic requirements. The possibilities for new discoveries in the post-war period were slight, but not without foundation, since thorough geological exploration had never been accomplished in full. Magnesium is considered to be in unlimited quantity, since it can be extracted from seawater, but commercial production from that source has yet to begin.

Iron ore is present in only small quantities. The major deposit is near Kamaishi in northeastern Honshu, where reserves amount to some 35 million tons of magnetite averaging 60 per cent iron. Lesser deposits, chiefly bog ore, are found in Hokkaido; also, extensive deposits of iron-bearing sands of 30 per cent iron, as yet unexploitable economically, are found in northeastern Honshu. Domestic sources supplied only 12 per cent of Japan's needs before World War II, and, as they become depleted, will remain inadequate to satisfy more than a small percentage of requirements. Imports of at least 2.2 million tons of ore a year will be required; more will be needed as domestic supplies dwindle and industrial expansion develops. In 1952, Japanese iron ore production totaled 1,135,000 short tons of ore, averaging 50 per cent of metal content.

Deposits of low-grade manganese ore are found scattered throughout the islands, but are inadequate for more than a small percentage of requirements. Nickel deposits are even more deficient, and resources of tungsten, molybdenum, vanadium, cobalt, and titanium are meager and inadequate. Tin and antimony deposits also are small and cannot be expected to supply more than 15 per cent of domestic requirements—and then for a short time only. Lead reserves are estimated at 11 million tons of ore containing some 130,000 tons of metal. Annual production is approximately 14,000 tons of metal, about one fifth of the anticipated demand. As for aluminum, there are no bauxite deposits of consequence in Japan, no known aluminum shales, and only small quantities of alunite. Prewar production of aluminum was based on imports of bauxite from eastern Asia and the Western Pacific and of alunite from Korea. Extensive deposits of high-alumina clays are scattered over the islands, but an economical process for their utilization has not been developed.

Gold and silver are found in much of Japan proper, in sufficient quantity to supply anticipated domestic needs. Platinum, however, is available only in minute quantities. Chromite deposits apparently are extensive enough to meet domestic requirements for some years, an estimated maximum of 800,000 tons of ore being in reserve. The chief mines are in southern Hokkaido and in the Okayama-Tottori area of south central Honshu. Production in 1951 reached 15,800 short tons of chrome oxide from ores grossing about 40,000 tons.

Until 1935 Japan produced domestically almost all of the copper she consumed, but thereafter imports rose to meet increased industrial and military demands. Annual production (estimated at 77,000 short tons in 1939 and 59,000 tons of metal in 1952) is sufficient to supply ordinary peacetime needs, although most of the Japanese copper mines have been worked for many years and the best ores have been consumed. The chief exploited deposits are in Akita, Ibaraki, and Tochigi prefectures in central and northern Honshu, and in Ehime Prefecture in western Shikoku. Zinc deposits, estimated at 2 million tons of metal, also should be sufficient to meet annual needs. Production in 1952 was 96,000 short tons of metal. The chief mines are in Gifu, Iwate, and Miyagi prefectures in Honshu, several of which are also major lead producers. Although Japan had been a major importer of zinc since 1900, increased domestic output after 1940 practically eliminated imports.

Coal.—The most important and valuable of the minerals in Japan is coal, whose value amounted to more than half of all the minerals produced in Japan in 1936. Proved, probable, and possible reserves are estimated at 18 billion metric tons, of which almost half is in Hokkaido and 38 per cent is in Kyushu. More than three fourths of Japanese coal is a low-grade bituminous; only 4 per cent is believed to be anthracite; and the remainder is sub-bituminous. Production is costly because of fragmentary, thin, and crooked coal seams; large amounts of ground water in the mines; and the limited use of mechanized equipment. Per ton costs before World War II were almost twice those in the United States; and in 1936 the output per underground worker in Japan was 318 tons, as compared with 1,010 tons in the United

States in the same year. Furthermore, Japanese coal is not only ashy and high in volatile matter, but its calorific value averages between 11,000 and 13,000 British thermal units (Btu.), as compared with a typical United States figure of over 14,000 Btu.

Despite the primary position occupied by coal in Japan's mineral resources, the per capita reserves amount to only 220 metric tons, as compared with the United States figure of 27,000 metric tons and the United Kingdom's 4,200 metric tons. Japan's coal deposits, though by far the most fully exploited in the Far East, are still small in comparison with those of the world's major coal-producing areas.

Coal production during the war averaged close to 60 million short tons annually, as compared with 40 to 50 million tons in the immediate prewar period. By 1947 production had declined to 32 million tons; by 1952 it had risen to 49 million tons, at which figure reserves should last some 200 years. The estimated needs are approximately 50 million tons annually, and production should meet almost all of that demand. Unfortunately, the high-volatile Japanese coals are unsuitable for coking purposes. Formerly coking coal was imported from north China, Manchuria, and Korea. A minimum of 1 million tons of this higher-quality coal must be imported, at least until such time as technological advances make it possible to convert economically Japanese coals to coke.

In addition to the coal reserves there are extensive lignite deposits which are variously estimated at 500 to 2,200 million tons. Most of them, however, are relatively small, scattered, impure, and underground; therefore, technical production problems of size exist. Until 1940 very little lignite was mined (less than 300,000 metric tons a year), but by 1947, 3,250,000 short tons were produced. With increased coal production, however, lignite output fell to 1,700,000 tons in 1952. Although useful primarily as a heating fuel, the 5 to 10 million tons of lignite producible annually would do much to alleviate the fuel shortage in Japan.

Although Hokkaido contains more than half of the total Japanese coal reserves, it produces less than one third of the coal mined and until the outbreak of the Sino-Japanese War in 1937 produced less than one quarter. The greatest output has come from the coalfields of northern and western Kyushu: about 57 per cent in the period 1935-1945. The prospects for future development in Hokkaido, however, are better than in Kyushu, since many of the best seams in the latter island already have been exploited. There are several smaller deposits in Honshu, the chief of which is the Joban field in Fukushima Prefecture, which supplies much of the fuel coal for the Kanto area, and the deposits in western Yamaguchi Prefecture, largely sub-anthraxite, which are ancillary to the northern Kyushu fields. Numerous other deposits exist and are mined in small quantities for local consumption, but Shikoku is said to be without any coal at all.

Petroleum.—Reserves of petroleum were estimated in 1951 to be about 26 million barrels, a negligible quantity for any modern industrialized country. It was possible that this estimate was too low; geological surveys indicate the possibility of additional reserves, but at most Japan will be able to supply only a small per-

centage (10 to 15 per cent) of her petroleum needs, and then only for a limited time. Before World War II, Japan imported almost 90 per cent of her petroleum and petroleum products, and a similar percentage of imports was required in the postwar period. In 1952, Japanese production totaled 2,100,000 barrels, less than 10 per cent of total consumption. The main Japanese oilfields are in Akita and Niigata prefectures in northwestern Japan; secondary pools are found in western Hokkaido; and all belong to the same geological formations.

Minerals Used in the Chemical Industry.—Of these, eight may be considered basic: coal, copper, nitrates, limestone, and sulphur, all of which are produced in sufficient supply in Japan; and salt, phosphates, and potash.

Coal and copper are in adequate, though not in generous, supply. Nitrates, essential for the manufacture of agricultural fertilizers, can be produced artificially by the nitrogen-fixation process. Both high- and low-grade limestone is abundant in Japan and quarries are located on every island. Recorded production, concentrated largely in northern Kyushu, in 1939 was 813 million tons and actual production is believed to have been 20 per cent greater. Reserves are sufficient for at least 200 years and considerable exports are possible. Sulphur likewise is sufficient for anticipated needs. Reserves of close to 60 million tons are known, including 20 million tons of native sulphur and nearly 40 million tons of sulphur content in pyrite deposits. Production in 1952 reached 1,344,000 short tons, a quantity which slightly exceeded domestic demands and which could be produced without strain for another half century. Refined sulphur constituted 156,000 tons of production, the balance coming from pyrites which are used primarily for the production of sulphuric acid.

The lack of adequate supplies of salt in Japan may seem strange in view of the insular nature of the country, despite the absence of deposits of rock salt. The coasts of Japan are dotted with small salt factories engaged in the evaporation of seawater and the extraction of salt. Climatically, however, there are few areas where rainfall is consistently light enough to permit solar evaporation of seawater. Even in the Inland Sea area, where the bulk of Japan's salt is manufactured, the rainfall is close to 40 inches and is spread fairly evenly over the year. Thus, final evaporation is effected in pans over fires of wood, charcoal, and coal or by electrical means (12 per cent before World War II). In 1936, 590,000 tons of salt were produced, while requirements amounted to more than 2.2 million tons. In 1952 production was only 497,000 tons, or about 20 per cent of consumption.

Both phosphates and potash are necessary for the fertilizing of infertile and overused Japanese soils. About 75 per cent of Japan's prewar potash needs and about 40 per cent of her phosphate needs were supplied domestically. Both these materials are derived largely from waste products: night soil, farm manures, bone meal, and fish meal. Some small percentages come from domestically produced bean and seed cake. It was expected that almost 1 million tons of phosphate rock and potassium salts would have to be imported by 1960 to maintain the productivity of cultivable land.

Lesser Minerals and Mineral Products.—Of these, Japan possesses adequate supplies of ar-

senic, bismuth, bromine, cadmium, garnet, iodine, mercury, clays, gypsum, sands and gravels, and building stones. Higher-quality building materials, however, are lacking, and the fine china clays for Japan's china export industry, as well as refractory clays, kaolin, and fine glass sands, are imported. Asbestos, fluorspar, mica, and graphite also must be imported.

Fiber Resources.—It is questionable to what extent Japan is deficient in the domestic production of fibers. She has a supply of wood fibers from her forests and an almost unlimited supply of straw from her grain fields. But in the competition with food crops for agricultural acreage, textile fiber crops have done poorly, especially since 1940. The approximate annual production of hard, chiefly textile, fibers in Japan is 77 million pounds. About one third of this quantity is silk; another third, hemp; and the remainder, flax, jute, ramie, and cotton. The 77 million pounds produced can be compared with the 872 million pounds of fibers necessary for a population of 87,200,000 at a per capita quota of 10 pounds. Furthermore, no wool to speak of is produced in Japan, very little leather relative to the demand, and no rubber. The deficit conceivably could be balanced by the use of wood pulp for rayon, but only at the expense of other wood uses. Since in the postwar period there was a deficit anticipated for some years in wood production, the complete elimination of fiber shortages through the use of wood products seemed hardly probable, though in the long run possible.

Japanese farmers produce an estimated 42 billion pounds of straw fiber each year. About 10 billion pounds is available for fiber uses, hats, mats, raincoats, sandals, rope, packing, wall-board, paper, and padding. Another 13 billion pounds is used for fodder, compost, thatch, and fuel, the remainder being unused or unusable.

Silk has long been the great textile fiber of Japan and was the leading item in its export trade to the West for decades. Most production is conducted as a cash-crop auxiliary to agricultural activity. Silk is far from being a cheap fiber, however, even in Japan, and the costs of producing mulberry leaves, necessary for the raising of cocoons, are maintained at a high level by the pressure on arable land for food-raising purposes. This pressure, as well as the loss of much of the United States market for Japanese silk, was reflected in the diminution of mulberry acreage from 1.45 million acres in the 1931-1940 period to 428,000 acres in 1952. Production likewise has declined, from 95 million pounds in the prewar period to 33 million in 1952. It appears, therefore, that increases in silk production would help counteract part of the deficit in hard fibers, but only at a relatively high price and at the expense of some food production.

Among other possibilities for expanding fiber production was the increased use of inner bark from the silkworm mulberry varieties and related species. In addition, the utilization of synthetic fibers other than rayon (nylon and the like) was anticipated, but no production in quantity had taken place by 1952.

If Japan were to regain an export trade at all similar to that preceding World War II, it would be necessary for her to import vast quantities of raw cotton and wool as well as wood pulp, abaca, jute, ramie, kapok, and flax. Therefore, although by the judicious utilization of wood

pulp and straw Japan might counter certain of her fiber deficiencies on a domestic basis, for the re-establishment of overseas trade she would continue to be a fiber-deficit country. See also section on *Agriculture*.

Power and Fuel Resources.—Japan is fortunate in having a relatively high hydroelectric power potential due to the ample precipitation throughout most of the country and to a mountainous topography laced with short, swift-flowing streams. On the basis of a six-month flow, the potential waterpower available is estimated at 10.9 million kilowatts. At the beginning of 1951, Japan had 1,424 hydroelectric plants in operation with an installed capacity of 6.56 million kilowatts. Several plants were under construction, and were expected by late 1953 to bring the total hydroelectric capacity to 6.94 million kilowatts. Most of the plants are small. In 1951, 88 per cent of them had installed capacities of less than 10,000 kilowatts. Of the 51.6 billion kilowatt-hours produced in Japan in 1952, 78 per cent were of hydroelectric origin.

On the other hand, hydroelectric power plants operated at an average of only 66 per cent of theoretical capacity in 1950. The reasons for this seeming insufficiency are two: (1) the irregularity of rainfall and runoff, which has prevented the even distribution of power production over the months; (2) the scarcity of storage dams and reservoirs, the means for equalizing water resources over the year. Only an estimated 1.2 billion kilowatt-hours, or 3 per cent of total annual production, are available from existing storage facilities. Hydroelectric plants are scattered throughout Japan, but are concentrated in greater numbers in certain areas. In terms of percentage of national hydroelectric capacity in 1951, the plants were distributed as follows: in Kanto, 23.7 per cent; in Kansai or Kinki, 19.1 per cent; in Tohoku, 16.2 per cent; in Chubu, 12.8 per cent, and in Kyushu, 9.5 per cent; the balance was spread in other areas.

As a supplementary source of power there were at the beginning of 1951, 273 thermoelectric plants in Japan with an authorized capacity of 3.99 million kilowatts. These, combined with the hydroelectric plants, gave Japan a total electric power capacity of 10.55 million kilowatts, roughly equal to that in the states of Illinois and Michigan combined. This figure is misleading, however, since neither the hydroelectric nor the thermoelectric plants operated at full capacity. The actual production from public utility thermoelectric plants in 1949 was estimated at about 40 per cent of the installed capacity, and at no time has the actual output amounted to more than 75 per cent of capacity even under the press of wartime conditions. Although thermal plants are distributed widely, there are major concentrations in the Kansai or Kinki region (32.2 per cent at the beginning of 1951), in Kyushu (22.5 per cent), in the Kanto region (12.5 per cent), and in Chugoku (11.2 per cent). The largest thermoelectric plants are in Osaka-Kobe, Tokyo-Yokohama, and Nagoya. Since the monthly variations in hydroelectric output may amount to some 1.1 billion kilowatt-hours, 40 per cent or more of the thermal plants are necessary for standby and auxiliary purposes. The remainder are necessary where hydroelectric power is inadequately supplied, as in the largest cities.

When reduced to equivalent heat units, all

domestic sources of fuel and power can supply 90 million Japanese annually with 16.9 million Btu. per capita. About 75 per cent comes from coal and lignite, 9 per cent from hydroelectricity, and 12 per cent from fuel wood. If total mechanical power is considered, however, it is estimated that there will be an equivalent of 1,353 kilowatt-hours per capita available. Of this energy, 56 per cent is from coal and 33 per cent from hydroelectricity, with coal increasing somewhat in importance in relation to hydroelectricity. This compares favorably with the per capita consumption in 1930-1934, but falls far short of the consumption after 1936; it is equivalent, however, to only about 10 per cent of the per capita electrical equivalents available in the United States in 1945.

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5. AGRICULTURE. Agriculture is the backbone of Japan's economic life. The unprecedented progress of industrialization in Japan before World War II tended to obscure this fact, but in reality the importance of agriculture was very great even then. The war saw the destruction of much of Japan's industrial fabric and the loss of many of her foreign markets. Agriculture was the only segment of Japanese economy that survived the defeat of the country in relatively good condition. In 1952 the rural population accounted for almost 43 per cent of Japan's 86,000,000 people and provided from 80 to 85 per cent of the food consumed by the Japanese. In terms of capital invested and net value of output, agriculture is by far the country's leading industry. And all this agricultural structure rests on only 15 million acres of cultivated land, made up of minute, well-tilled farms and gardens.

Roughly 75 per cent of the area of Japan is hilly or mountainous, with slopes usually too steep, and soils too thin, for ordinary cultivation. With a few notable exceptions, the typical Japanese plains consist mainly of narrow coastal lowlands; they are found also along the banks of some of the larger rivers or along the bottoms of narrow, steep-sided valleys. This preponderance of highlands with steep slopes and rock wastes sets definite and striking limits to the cultivated area and explains why only some 16 per cent of the total estimated land area of Japan is cultivated. Compared with that of other countries, the ratio is small; before World War II, Italy cultivated 41 per cent, Germany 40 per cent, France 39 per cent, and Great Britain 22 per cent, of the total land area. Even in the continental United States, 18 per cent of the total area is under cultivation. See also section on *Natural Resources*.

Climate.—In northern Japan, where snowfall is heavy, a second crop on rice fields is very difficult, if not impossible; where it is practiced, damages are extensive. Somewhat the same is true of frost in the north and in some other regions of the country. The typhoon, too, contributes its share of damage. It is almost a yearly occurrence, usually taking place in August

and September. The typhoons are accompanied by severe rainstorms that bring in their wake floods and damage to crops.

From the point of view of utilizing fully the available soil resources, Japan enjoys ample precipitation. Rainfall for the entire country ranges between 40 and 100 inches annually. From north to south, and through the entire north and some of central Japan, precipitation varies from 40 to 60 inches. The heavier rainfall occurs west and south of this belt. The seasonal rains in June and July, together with the fairly dry weather in August, are peculiarly suited to the growing of irrigated rice. On the whole, precipitation is sufficient to meet the needs of Japanese agriculture, and normally almost no region suffers from a shortage of water for crops. Occasionally rains result in devastating floods; for example, in 1953 they caused considerable loss of life in Kyushu as well as property damage estimated at \$100 million.

Soils.—There are many kinds of soil in Japan, but for purposes of description, three main groups may be defined: (1) the podsolc soils of a large part of Hokkaido and of the highlands of Honshu; (2) the brown soils of southwestern Hokkaido and the northern and central parts of Honshu; and (3) the yellow and red soils of the remaining part of Honshu, together with all of Shikoku and Kyushu.

Japanese soils are not naturally very fertile. The greater part appear to be inferior in this respect, and high yields seem to have been obtained in most cases only by careful attention to the needs of each particular soil situation. In upland and paddy soils, where a legume is grown as a winter crop, lime must be applied to make up the deficiency of calcium. The application of phosphorus is often found profitable, and in certain cases potash is necessary. Nearly all the soils are strongly deficient in nitrogen. A painstaking effort to meet the needs of these soils is the chief reason for the success Japanese farmers have had in securing high levels of production.

Farm Population.—In the mid-19th century, when Japan came into contact with the West, almost 80 per cent of the people were classed as farmers. The proportion of farmers in the total population decreased to 48 per cent by 1930, and to 40 per cent by 1939. This decline in ratio was due not to a decrease in the farming class but to an increase in the nonfarm population. There was, in fact, an increase in the total number of agricultural families, which reached a prewar maximum of 5,642,500 in 1932, compared with 5,518,000 in 1886. The number of farm families in 1947 was 5,900,000, and in 1952 it was estimated at 6,200,000. The rise in the number of farm families was attested by the general rise in farm population. After World War II the total farm population increased to a point where it constituted almost half the total population in 1949. This was in no way a reflection of any improvement, or greater absorptive capacity, of Japanese agriculture. On the contrary, it reflected the immediate postwar industrial and commercial dislocation of Japan, the country's slow economic recovery, and, by the same token, the steady movement of expatriates and unemployed from the cities to the villages, where they hoped to eke out a living from the farms of their relatives. Economic recovery thereafter served to reduce the ratio of farm population to the total.

Land Utilization.—The land of Japan falls into four groups: cultivated, forest, pasture, and wasteland (*gen-ya*) and land under various other uses. In 1939, cultivated land represented 16 per cent of the total area; forest land, 55 per cent; pasture, 8 per cent; and land in other uses, 21 per cent. This relationship had not changed to any material degree by 1954.

Forested hills and mountains, which account for 55 per cent of the country's surface, are the basic limiting factor in the expansion of the cultivated acreage. The forests are primarily mountain forest and generally of poor quality. Nearly half of them consist of dwarf woods fit only for fuel. The grasses of the pasture land are of poor quality, and the limited attempts to improve them have not been successful.

Cultivated land is scarce in relation to the rapidly growing population as a whole as well as to the farm population. The Japanese government has been well aware of this fact, which explains to a degree not only the development of industry and foreign trade, but, above all, the official policy of attempting to increase crop acreage and the productive capacity of the land.

By the time of the Meiji Restoration of 1868 most of the level land had already been taken up by the farmers. To increase their acreage they had to turn, and successfully, to the remaining lowlands, the mountain slopes, and the hillsides in spite of heavy expenditures and other unfavorable conditions. The cultivated area between 1880 and 1921 increased 36 per cent, from 10.5 million to about 15 million acres. Since 1921 the cultivated acreage has remained almost unchanged. In fact, due to acquisition for military purposes, the cultivated area actually decreased by about 500,000 acres between 1937 and 1945.

The effort to expand the land under cultivation gained momentum early in the Allied occupation of Japan following World War II. Former military land and other readily available tracts were promptly made available for cultivation. The Japanese government estimated that nearly 4 million acres were still reclaimable as crop land. In the main, this was a rather optimistic estimate. Since most of the desirable land was already in use, the greater part of the reclaimable land left was inferior to the land in cultivation. The cost of reclamation on some land was prohibitive, and land which was not suitable for reclamation was included in the program.

In 1954 the total arable land was estimated at 15.5 million acres. The acreage would have been larger but for the fact that a good deal of land had shifted to nonagricultural purposes. A total of 880,000 acres of uncultivated land had been reclaimed from September 1945 to July 1, 1949, providing new farms for 172,000 settlers and additional cultivated land for 500,000 local farmers. By the end of 1951 a total of over 1,000,000 acres had been reclaimed. It should be noted, however, that this was land that lent itself to reclamation very easily and at relatively little expense.

Farming Practices.—*Intensive Cultivation.*—Since the pressure on the land is so great, the fields of Japan are cultivated intensively; they are treated much more carefully than many a garden in other parts of the world. The rice fields are graded to level, and each is surrounded by dikes. Many of the upland fields are also leveled and made secure by terracing. Leveling not only facilitates working, but enables the land to retain

all natural or artificial fertilizers, making possible the continuous growing of such heavy-yielding crops as irrigated rice, as well as multiple crops on the upland. All this calls for an immense amount of labor. Careful cultivation, constant weeding, repeated applications of fertilizers, painstaking watering of crops where irrigation is lacking, multiple cropping—all these are indicative of the intensive cultivation of the fields.

Multiple Cropping.—A characteristic feature of Japanese agriculture is that two successive crops are grown each year on a large part of the land. Two crops of rice are rare, but from 30 to 40 per cent of the irrigated rice land, except where the climate is least favorable on account of severe winters, is replanted to winter crops, such as wheat and barley. On the upland fields (unirrigated cropped land) also, the same unit of land produces more than one crop each year, farmers commonly having three or more crops growing at the same time in different stages of maturity. Because of the practice of double and multiple cropping, there is a distinction in Japan between cultivated and harvested area. For instance, in 1939 Japan's harvested area amounted to 20 million acres, or one third more than the land reported as cultivated. Practically the same was true in 1952.

Fertilizing.—Fertilizers are of unusual importance in a country like Japan, where the system of agriculture is very intensive and a scarcity of agricultural land makes it important to secure high yields from every field. Understanding the necessity to fertilize, Japanese farmers for many years have fully utilized materials locally available—mainly compost, night soil, green manure, and wood ashes. Bean cake and fish fertilizers were added to this list following a development of the soybean industry in Manchuria and of the fish-packing industry in Japan. More recently, large quantities of chemical fertilizers, particularly ammonium sulphate and superphosphate, have also been employed.

It is a common practice of farmers in Japan to dump fertilizers of various kinds into a shallow cement storage cistern to which water is added. The manure is allowed to decompose, and when field applications are to be made, the liquid fertilizer is ladled out of the cistern and carried to the field in large wooden buckets. The Japanese farmer does not spread the fertilizer over his field, but applies it directly to the growing plant. It is poured over the plant so that only the soil next to the crop is fertilized.

Despite the great importance of chemical fertilizers in Japanese agriculture, the role of farmyard manures is undiminished. It is estimated that during 1936–1940 the percentage of the total quantities of fertilizer nutrients supplied by farm manures was as follows: nitrogen (N), 48 per cent; phosphoric acid (P_2O_5), 35 per cent; potash (K_2O), 74 per cent. In 1946 total consumption of farm manures (compost, night soil, green manures, and others) on a fertilizer-equivalent basis was 4.5 million tons.

In 1935–1937, it was estimated that in terms of pounds per acre of arable land, Japan was third among the nations of the world in the total amount of nitrogen derived from organic and inorganic fertilizers, with 37 pounds per acre of arable land; fifth in phosphoric acid, with 34 pounds; and fifth in the amount of potash, with 15 pounds. During the same period, Japan was the world's largest user of ammonium sulphate.

In the 1920's and 1930's, Japan built up a large fertilizer industry. Peak production of commercial organic and inorganic nitrogenous fertilizers occurred during 1936-1940, when an average of 1,800,000 metric tons of ammonium sulphate equivalents was produced annually. Production of such fertilizers declined rapidly after 1941, and by 1945 it amounted to only 335,000 metric tons. The period 1936-1940 was also the peak period of production of inorganic and organic forms of commercial phosphatic and potassic fertilizers. The yearly average was 1,900,000 metric tons of superphosphate equivalents and 20,000 metric tons of potassium sulphate equivalents. In this instance, too, by the end of the war production was at its lowest level.

In consequence of a major effort on the part of the Allied occupation authorities and the Japanese government, the fertilizer industry made very rapid recovery after the war, but fertilizer availability was still far from prewar levels; in 1949 commercial organic and inorganic fertilizers accounted for only 64 per cent of the 1936-1940 average. In 1952, however, the fertilizer industry not only provided for the country's needs, but was in a position to export fertilizer products. In that year, Japan produced nearly 2,000,000 tons of ammonium sulphate equivalents (20 per cent N), 1,400,000 tons of superphosphate equivalents (16 per cent P_2O_5), 530,000 tons of potash (40 per cent K_2O), and a not insignificant quantity of other chemical fertilizers. The total volume of chemical fertilizers was in excess of 3,900,000 tons.

Use of Labor and Equipment.—The intensive work performed on Japanese farms from planting to harvesting is carried on almost exclusively by hand. With some minor exceptions, motor-driven machines are scarcely ever used in seeding, fertilizing, and harvesting, although animal power often is used in plowing. Even in Hokkaido, which is best suited to mechanization, animal-drawn farm implements have been in use for generations and no need has been felt for replacing them with modern equipment.

The farm equipment used in field work is light and of the simplest construction. The dikes and ditches could not stand heavy equipment and in the tiny fields too much maneuvering of the machinery would destroy the crop. Aside from physical factors, mechanization has been retarded for economic reasons. Human labor is abundant, and this fact in itself tends to preclude the use of labor-saving devices.

To assume, however, that mechanization is an unknown quantity in Japanese agriculture would be erroneous. Japanese farmers employ some mechanical equipment adjustable to the size of the farm, but it is employed to process agricultural products and no mechanical equipment is used directly in raising crops. Before World War II, for example, one electric motor was used per 107 farm families, and one gasoline engine per 22 farm families. The electric motors averaged not more than 1.5 horsepower; the gasoline engines, 3 horsepower. After the war there was a sharp increase in the utilization of farm equipment, some motorized. Between 1937 and early 1952 the number of threshers (129,000) and hullers (192,000) increased threefold; that of mechanical pumps (44,000) more than threefold, and that of electric and gasoline engines from 188,000 to nearly 650,000. Considering the number of farm households, the use of such equipment

was far from widespread, but progress was undeniable.

Livestock.—Japanese agriculture has only a limited livestock industry despite the preponderance of highlands. There are two principal reasons for this: (1) There is a lack of good natural pasture land, because the native wild grass is coarse and unnutritious and generally crowds out the valuable forage grasses. (2) Farming is limited to the cultivation of the soil for the produce derived directly from it, because in a densely populated country with limited food resources the food value produced from an acre under grains is 6 to 7 times larger than the food value of the meat or milk that can be obtained by feeding the grain to livestock.

Cattle and horses are raised chiefly for draft purposes and for stable manure. The total number of cattle prior to World War II averaged 1,800,000 and reached a peak of 2,300,000 in 1945. In the immediate postwar period the number was considerably reduced, but it was estimated that in 1949 it attained the 1945 level. Horses in 1949 were estimated at 1.1 million, or about one fifth less than in 1930-1934. Hogs play a particularly small role in the farm economy of the average farmer, and at no time has their number exceeded 1,000,000. They declined sharply in the war and postwar years, and in 1949 there were only about 500,000 hogs in Japan. By 1953 the livestock industry was above prewar levels in virtually every category; the most notable gains were in cattle, horses, sheep, and poultry. Yet numbers were still small in relation to the number of farm households. In 1952 the number of cattle per farm household averaged .4; that of horses, .3; that of hogs, .2. Japan has considerable possibilities of increasing and improving its livestock industry, but in order to do that it must concentrate on the formidable task of improving its pasture and grazing lands.

Agricultural Production.—The cultivated land of Japan falls into two main groups: (1) rice fields (irrigated land), and (2) upland farms (unirrigated land) that produce other crops. Many of the cultivated crops in the uplands are also grown on rice fields as winter crops.

A distinguishing feature of Japanese agriculture is the preponderance of food crops, of which rice is the most outstanding. The emphasis upon rice is probably no accident, because the type of agriculture developed has been influenced largely by the amount of cultivable land available in relation to the population. With relatively little land suitable for cultivation, with a rapidly growing population demanding larger supplies of food, and with a fixed government policy to encourage self-sufficiency in food, the concentration upon food crops was natural. Rice became the dominant food crop because under Japanese conditions it yields more calories per unit of land than any other cereal. Individually, other food crops are not so important to Japan as rice, but taken together they utilize over 40 per cent of the harvested area. All food crops together account for four fifths of the land under crops.

During World War II and immediately thereafter agricultural production in Japan declined, but thereafter considerable recovery took place. This was particularly true of food crops. Just before the war the harvested acreage under food crops was slightly over 14 million acres, or only 150,000 acres more than the area under the same crops in 1948. The general trend of acreage,

Table 1—ACREAGE, YIELD, AND PRODUCTION¹ OF THE MAJOR CROPS OF JAPAN
Averages, 1935–1939 and 1940–1944; specified years, 1945 through 1952

Period	Rice ²			Wheat			Barley		
	Planted area (1,000 acres)	Yield (bushels per acre)	Production (1,000 bushels)	Planted area (1,000 acres)	Yield (bushels per acre)	Production (1,000 bushels)	Planted area (1,000 acres)	Yield (bushels per acre)	Production (1,000 bushels)
1935–39	7,862	76	595,845	1,735	29	49,954	844	41	34,559
1940–44	7,659	73	556,057	2,044	26	52,228	933	36	33,170
1945	7,089	64	456,667	1,789	19	34,660	990	25	24,587
1946	6,871	82	560,660	1,562	15	22,613	910	21	19,160
1949	7,377	78	571,147	1,680	23	39,279	961	37	36,054
1950	7,441	79	587,629	1,888	26	49,180	1,060	39	41,175
1952	7,436	81	604,188	1,782	32	56,480	1,008	49	49,512
Naked barley				Sweet potatoes			White potatoes		
1935–39	1,044	30	30,842	618	203	125,620	385	166	64,101
1940–44	1,164	28	32,113	697	201	140,308	467	152	70,817
1945	1,180	22	26,471	988	158	156,209	527	124	65,094
1946	1,101	15	16,565	921	240	221,047	477	136	64,678
1949	1,275	25	32,187	1,038	204	211,441	544	142	77,161
1950	1,460	27	39,032	983	265	260,150	475	189	89,729
1952	1,290	38	49,604	932	267	248,702	489	189	92,409
Mulberry ³				Tea ³			Millets		
1935–39	1,308 ⁴	574 ⁴	750,814 ⁴	96	1,192	114,451	306	25	7,636
1940–44	1,014	502	508,695	89	1,410	125,456	247	21	5,219
1945	526	354	186,210	65	802	52,150	236	13	3,034
1946	400	295	117,919	60	787	47,219	242	20	4,849
1949	457	301	136,244	67	1,119	74,970	261	20	5,099
1950	450	346	155,865	67	1,372	91,932	309	23	7,029
1952	428	532	227,730	74	1,728	127,867	275	25	6,914

¹ The weights of the various bushels are as indicated: rice (rough), 45 pounds; wheat, 60 pounds; barley, 48 pounds; naked barley, 61 pounds; sweet potatoes, 55 pounds; white potatoes, 60 pounds. The data on millets include foxtail, barnyard, and proso millet, which weigh, respectively, 56, 33, and 49 pounds per bushel.

² The prewar and 1940–44 averages are not comparable with the yearly averages because the Japanese Ministry of Agriculture and Forestry has since improved its methods of crop estimating.

³ For tea and mulberries, production is expressed in thousands of pounds, and yield in pounds per acre.

⁴ 1939 only.

Source: Foreign Agricultural Service, United States Department of Agriculture.

production, and yields before and after World War II are shown in Table 1. With the exception of the wheat acreage and that under mulberry and tea, the recovery was very marked, and it should be noted that the decline in the acreage planted to tea and mulberry was due to a sharp decline in foreign demand for tea and silk.

In 1952, as in the past, rice dominated Japanese agricultural economy. Fully 55 per cent of the cereal acreage was under rice. Rice is used at practically every meal; although other grains are consumed, they supplement rather than replace rice. Efforts to increase the yield of rice have been most successful and Japanese yields are the highest in Asia. In comparison with other principal rice-producing countries, such as Indochina, the Philippines, Thailand, Burma, and India, the Japanese yields are from two to three times larger. This success was achieved through ample use of manpower, improved rice varieties, abundant use of fertilizers, and improved agricultural practices. In Japan, 96 per cent of the rice acreage is irrigated; the remaining upland rice area is without irrigation. The cereal is planted in May and June and harvested from August to November.

Despite the high yields of agricultural products, however, the total output is not sufficient to provide the country's basic food requirements. Before the war Japan had to import approximately 15 per cent of the food it consumed. The annual production of staple crops (rice, wheat, barleys, sweet and white potatoes) in terms of

brown rice equivalents reached a prewar peak of 14,615,000 metric tons in 1939. During the war years, production held up well until 1945, when fertilizer shortages and unfavorable weather caused short crops. In 1948, total production of staples was 13,927,000 metric tons, or 6 per cent more than the average annual production of these crops during the period 1931–1940, but still 5 per cent less than in 1939. In the meantime the total population of the country had increased by more than 10 million and the food shortage in terms of prewar consumption was greater than ever before. The estimated deficit in terms of staple food requirements for the year 1952 was nearly 4 million metric tons. Japan's chances of becoming self-sufficient in food in the foreseeable future were rather poor. Any success in such an attempt would depend upon one or more of the following factors: (1) expansion of arable acreage, (2) higher yields, (3) additional labor for the cultivated acreage, and (4) the effect of agrarian reform upon the food supply. An examination of the likely trends in the development of these factors indicated, however, that Japanese agriculture would not be in a position to satisfy the basic food requirements of the growing population. On the contrary, Japan's dependence upon imported foodstuffs would continue to grow.

Social Factors in Japanese Agriculture and Postwar Changes.—The fact that more than 6 million farm families cultivate 15 million acres of land indicates that the size of the farm units is quite small, averaging about 2.5 acres. In

southwest Japan, farm units are generally under 2 acres in size, with some of the holdings along the Inland Sea averaging 1.5 acres. In northern Honshu this figure increases to 3.5 acres, and only in the northernmost, sparsely populated island of Hokkaido do the farms average 12.5 acres. The size of holdings actually cultivated shows that approximately one third of all households cultivate less than 1.2 acres each; 33 per cent, from 1.2 to 2.4 acres; and only about 10 per cent, more than 5 acres. Moreover, the 15 million acres of cultivated land are divided into approximately 100 million plots, which means that most Japanese farmers work on small plots, often resembling gardens rather than fields.

Before the Allied occupation of Japan in 1945 one of the characteristic features of the Japanese land system was the striking concentration of land ownership. About 50 per cent of all the farm households owned only 9 per cent of all the land, whereas 7.5 per cent of the households owned 50 per cent of the land. The corollary of this situation was that the holdings cultivated by a Japanese farmer did not correspond with the amount of land owned by him. This inequality in landownership was expressed in terms of owners, part owners and part tenants, and tenants. Until the end of 1947 about 31 per cent were independent farm owners; 42 per cent, part tenants and part owners; 27 per cent, tenants who owned no land at all.

The small acreage cultivated by the average farmer was in itself an explanation of his poverty, but the situation was made worse by widespread tenancy and by the conditions under which the tenants worked the land. Land hunger and the intensity of competition for land ownership and cultivation rights preserved land values and rental rates far above a level justifiable by the productivity of the soil. Rentals of 50 per cent of the rice crop and only slightly less of other crops were customary. In addition, the tenant had to meet a number of other assessments and dues, buy his own expensive fertilizer, and provide the farmhouse, farm buildings, implements, and seed. The share from which he drew his living frequently represented not more than 30 per cent of the crop. Under these conditions the life of an average Japanese tenant prior to World War II conformed to the feudal adage that "farmers should neither live nor die."

The lot of the small owner-cultivator was better only by comparison. Until the more prosperous war and postwar years the standard of living of the vast majority of the Japanese farmers was very low. And it is precisely the marginal existence of the small Japanese owner-cultivator and tenant that explains, but only in part, why Japan's 15 million acres of cultivated land can support more than 6 million farm families. The results of numerous studies carried out by the Ministry of Agriculture before the war indicate that the average peasant generally could not make ends meet solely by farming. Even the peasant proprietor had practically no surplus at the end of the year. Naturally, the status of the tenants was considerably worse. Subsidiary occupations, therefore, have always played an important role in the life and work of the Japanese farmer. It has been estimated that the income from such sources ranged from one fifth to nearly one third of the total income before the war.

That agriculture was not a sufficiently profitable enterprise for most Japanese farmers, espe-

cially for tenants and part tenants, is further indicated by the fact that a Japanese farmer could count upon a surplus only when his holding was about 4.5 acres, or nearly twice the theoretical acreage he cultivated. Even the industry and thrift of the farmer cannot obviate the fact that the income of a farm family is the product not only of output per acre, but of the number of acres as well. In Japan the output per acre is large compared to that of most Western countries, but the acreage per farm is so small that the total income per family is only a fraction of that in the West.

Farm living conditions improved during and immediately after the war in consequence of great food shortages, inflationary conditions, high prices, and black marketing. It was clear, however, that this essentially paper-money prosperity was not going to last very long and that the basic economic and social problems of the Japanese countryside would reassert themselves unless drastic changes were affected in the existing land ownership pattern, in the cooperative movement, and in the services rendered by agricultural research and science. With that view in mind, a strong effort to improve the conditions of the majority of the Japanese farmers and to give rural Japan a greater measure of economic, political, and social stability was made under the direction of the Allied powers after their occupation of Japan.

Land Reform.—On Dec. 9, 1945, Gen. Douglas MacArthur, the supreme commander for the Allied powers (SCAP), issued a directive to the Japanese government that it "take measures to insure that those who till the soil of Japan shall have a more equal opportunity to enjoy the fruits of their labor." As a result of this directive, the Japanese government enacted, on Oct. 21, 1946, the Special Measure for the Establishment of Owner-Farmers (Land Reform Law) and Agricultural Land Adjustment Law of 1946. This legislation provided the legal basis for land reform. It had two main objectives: (1) transfer of land ownership to farmers who actually till the soil and (2) improvement of farm tenancy practices for those who continue as tenants. The underlying principle of the legislation was private rather than state, and individual rather than collective, ownership of the land.

In accordance with the main provisions of the legislation, all the land of absentee owners is made subject to sale. Resident landlords may retain 2.5 acres of tenant-cultivated land, except in Hokkaido, where they are permitted 10 acres. The size of holdings of owner-cultivators is also subject to limitations in order to place the ownership of the maximum amount of land in the hands of as many former tenants as possible. The government purchases the land at an average price of 3,000 yen per acre for rice land, and 1,860 yen per acre of dry or upland fields. In addition, the owners receive a government subsidy of 880 yen per acre for paddy fields, and 520 yen per acre for uplands. This subsidy, however, is not paid on more than 7.5 acres per individual seller in Honshu, Kyushu, and Shikoku, and on more than 30 acres in Hokkaido. The government pays the landlords in 24-year annuity bonds bearing interest at the rate of 3.65 per cent per year. A tenant may discharge his obligation in one payment or in several (not exceeding 30 annual installments), at an annual interest rate of 3.2 per cent.

Another basic provision of the land reform is the reduction in rents and the elimination of rent payments in kind at a fixed proportion of the crop. Rents must be made in cash at a stated amount, which may not exceed 25 per cent of the value of the rice crop and 15 per cent of the value of other crops. The land reform also outlaws a long-standing grievance of the tenants—the custom of renting by a verbal agreement which landowners might terminate on short notice. A written contract specifying the rent, the period of tenure, and other terms of the agreement is registered in the village office. It conforms to a model contract prescribed by the Japanese Ministry of Agriculture and Forestry.

By 1950 approximately 2.7 million cultivators—tenants or part tenants—had acquired in ownership 27 million separate tracts of land with a total area of approximately 4.5 million acres. The cultivated land area operated by tenants before the reform had been reduced from 6,300,000 acres to approximately 1,670,000 acres. Through these changes the lot of the average Japanese tenant had been measurably improved. They had finally achieved what every farmer the world over strives for—individual ownership of land. In achieving that they also secured a stake in the society in which they live, thus bringing Japan closer to the creation of a stable, middle-of-the-road agricultural society. Such an accomplishment marked a peaceful revolution in the social and economic pattern of Japanese agriculture and weakened measurably the tie that had bound the Japanese peasantry to forces of militant reaction and equally militant nationalism.

Cooperatives.—The brighter side of Japan's agricultural economy has been the widespread development of the cooperative movement, which has become the mainstay of the country's agriculture since 1900. The Japanese government and the farmers have understood that the extremely small size of the holdings makes it essential that farmers pool their efforts and resources through cooperatives. The main functions of the cooperatives are confined to the provision of credit, the making of sales and purchases, and the joint utilization of warehouses, milling establishments, and farm equipment. Between 1900 and 1939 the number of cooperatives increased from 21 to over 15,000 with a membership of nearly 7 million. Approximately 70 per cent of the membership was represented by farmers.

The Japanese agricultural cooperative movement was from its inception primarily a government-sponsored movement. During the war cooperatives became mere instruments for carrying out the aims of the military as they affected agriculture. They served to control agricultural prices and production, to handle collections and rationing, and to siphon rural capital for the war effort.

During the Allied occupation the cooperatives underwent certain changes designed to free them from undue domination by the government and to make certain that they were dedicated to the economic and cultural advancement of the Japanese farmers. In accordance with Law 132, which became effective on Dec. 15, 1947, the cooperatives were authorized to perform practically any economic service which contributes to the advancement of farm communities. Fifteen or more farmers may organize a cooperative. Membership is voluntary, and each farmer member has one vote. Persons residing within the business area

of the organization may be associate members with all privileges except voting. Two or more cooperatives may organize a federation of agricultural cooperatives; such federations may perform any activity which the local cooperatives are authorized to perform, except that if a federation is engaged in making loans and receiving deposits, it is prohibited from performing additional functions not connected with these activities. A cooperative may be organized as a capital stock or a nonstock association, but no nonstock association may carry on both the functions of making loans and of receiving deposits. Liability for a share is limited to the amount of the share or, in the case of a nonstock organization, to the amount of the authorized fee. The primary responsibility for carrying out the agricultural cooperative program is vested in the Ministry of Agriculture and Forestry. As of June 30, 1949, a total of 33,000 new cooperative associations and federations were approved under the new law. The volume of business recorded for the year 1948 shows that the cooperatives handled 36 per cent of all farm purchases, 61 per cent of all farmer sales, 64 per cent of financial deposits, and 71 per cent of loans to farmers.

Cooperatives are undoubtedly of great benefit to the farm community. In the past they alleviated many financial burdens, although they could not cure the problems of indebtedness, usurious interest rates, taxation burdens, and the unfavorable relationship between prices farmers received for their products and those they had to pay for the commodities they purchased. In 1954 it was safe to assume that, whatever the difficulties under which Japanese agriculture must operate in the future, the work of the cooperatives would undoubtedly serve to mitigate them.

Agricultural Research and Science.—One of the principal agricultural policies of Japan has been to increase production so as to make the country as nearly self-sufficient in food supplies as possible. Considering the agricultural resources of Japan, this policy has been successful. As early as 1879 the government launched a program of agricultural experiment work. It established and financed experiment stations where improvements in fertilizing, selection of seed, and development of new varieties first took place. These were subsequently applied by the farmers with telling results. In the words of a student of Japan's agricultural economy, the program was "a chemical and botanical revolution" fostered by the government. By the end of World War II, Japan had 386 national and prefectural agricultural experiment stations, 164 sericultural stations, 139 livestock breeding or animal hygiene stations, and 9 tobacco stations. In addition, there were 83 agricultural educational institutions, 20 miscellaneous government institutes, and 91 private institutions devoting at least part of their time to agricultural research.

The entire work of research and science in agriculture was decentralized, uncoordinated, and, in many instances, overlapping. The agricultural experts attached to SCAP recognized the notable results achieved by the Japanese in this field, but they also were aware that the existing agricultural experiment station system was not conducive to efficiency and coordination of research. In many instances individual stations did not have sufficient financial support to attract highly trained personnel, to buy modern equipment, and to deal successfully with the practical problems

confronting the farmers. The advice given to the Japanese government by United States specialists was embodied in the Law for Improvement and Promotion of Agriculture, enacted on July 5, 1948. The Agricultural Improvement Bureau, dealing with research, extension, and statistics, was established in the Ministry of Agriculture and Forestry in August 1948, to administer the new law. Research requirements were consolidated by 7 regions in order to determine the stations that could best serve the needs of the nation as a whole. The program provided that 135 stations be closed, 53 stations be combined, and 191 stations be continued. Funds, essential projects, and the best-trained personnel were to be transferred to the remaining stations. Prefectural agricultural experiment stations and their branches would be administered by a single staff in each prefecture. The National Agricultural Experiment Station and its regional stations would each have a separate administration, but the work of the branches would be directed by the national station.

Along with improvement in agricultural research and science, measures were taken to improve the means of transmitting technical knowledge to farmers. Since 1899, Japan has had an agricultural extension system under which the government provided each village with one or more agricultural technicians who worked with farmers in improving their agricultural practices. In addition, many of the agricultural cooperatives employed technicians to advise farmer members on production problems. This technical guidance and advisory service was effective, and it was a primary factor in the record increases in the yields of many crops in Japan prior to 1940.

Much of this extension work had fallen into disuse during the war years, and after the war an agricultural extension system was being developed under the provisions of the Law for Improvement and Promotion of Agriculture. More than 6,000 farm advisers were selected from lists of qualified candidates and assigned to duties as extension workers in the rural villages of Japan. The goal of the program was the assignment of an adviser for each of Japan's 10,500 villages. Of the 46 prefectures, 39 have from 2 to 13 home advisers engaged in field work, and more than 3,300 rural youth project clubs have been organized in farm communities.

Agricultural Prospects.—Even the most thorough agrarian improvements, economic and social, will not solve all the problems of rural Japan. There is simply not enough arable land in Japan to give the enormous farm population the reasonable assurance of a decent standard of living. If all the cultivated land in the country were to be equally distributed, the average holding would amount to only 2.5 acres, or nearly 2 acres less than the amount estimated as necessary to make farming in Japan profitable. Since the rural areas contribute the larger part of the annual increase in the Japanese population—at present (1954) somewhat more than 1,000,000—agricultural congestion is expected to be aggravated. Under the circumstances, the amelioration of the lot of the farm population, rather than an ultimate solution of the agrarian problem, is all that can be hoped for. Lasting answers to the problems which are inherent in an agricultural economy of "too many people on too little land" can come only through expanded industrialization and commerce, which decrease

Japan's dependence on home-grown food and absorb the surplus rural population, and eventually from a falling birth rate.

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6. INDUSTRIAL DEVELOPMENT.

The tempo of industrialization in modern Japan sustained over half a century has rarely been equaled in the Western World. When Commodore Matthew C. Perry visited the Japanese islands in 1853, he found a nation of approximately 30 million people living in a stage of economic development no more advanced than that of 15th century Europe. Most of them were unfree, impoverished peasants cultivating their tiny farms with primitive methods handed down from their ancestors. A meager development of internal trade and handicrafts supported the limited population of castle towns and cities. The latter found employment mainly in serving the needs of an aristocratic ruling class who lived off the proceeds of feudal rice revenues extracted from the farmers. By 1940 Japan had transformed herself into a front-rank industrial power. She now supported a population of 73 million people at a standard of living well above anything their grandfathers had known. A quarter of her working population was engaged in industrial pursuits, which had come to furnish 40 per cent or more of her greatly expanded national income. When this industrial potential was mobilized for total war after 1941, Japan quickly overran the entire Far East. She was only brought to her knees when the world's greatest industrial nation was free to project an overwhelming power across the Pacific and to strike against the shipping lanes and inflammable cities which were the arteries and heart of her modern industrial system.

Foundations of Modern Industry, 1868-1893.

—The foundations of industrial Japan were laid in the first quarter century after the Meiji Restoration of 1868. With feverish energy the young clan bureaucrats who had risen to national power around the emperor set to work to destroy the crumbling edifice of feudalism and build the new nation-state. Machine industry, mining, and commerce were among their most urgent concerns, for these could supply the economic sinews of national power. Students were sent abroad to learn the new Western technology; foreign experts were invited to Japan; machinery and equipment were imported in increasing amounts;

and state funds were applied to the founding of pilot factories, mines, and technical schools.

By 1893 industrial capitalism in Japan had passed through its early formative stage and was preparing for rapid expansion in subsequent decades. Here, as in other aspects of modernization, the Japanese responded eagerly to the quickening ideas and ambitions imbibed from the West. The speed and momentum of development, however, reflected a growing spirit of commercial and industrial enterprise long latent in Japan and now released from the stifling restrictions of the *ancien régime*. Other favorable factors of social tradition, geography, and historical circumstance also helped to produce aggressive leadership in forging a united nation able to seize upon the opportunities now afforded by entry upon the world stage.

Given Japan's tradition of mercantilism and feudal clan monopoly, it was natural that the new Meiji government should lead in industrial pioneering, in close association with influential commercial and industrial magnates. Moreover, only the state was able at this time to mobilize the necessary capital, to provide official protection, and to assume the inevitable risks. Railways, shipping, arsenals, foundries, silk filatures, cement and glass factories, coal and copper mines—almost every new industry—developed initially under government patronage if not under government ownership.

Even more important for industrial progress was the abolition by the state of feudal barriers to freedom of occupation and movement; the encouragement of foreign trade and contacts, and the creation of a national framework of government, finance, and communications. These architectural reforms provided a framework and a climate conducive to the growth of capitalist enterprise both large and small. Foreign markets bulked large, especially in the case of the rising silk industry, but the chief stimulus to manufacturing production came from the growing internal market, reinforced in the heavy industries by the building of the new army and navy.

After 1880 the industrial properties of the state were transferred largely to private ownership. Often this was done at bargain prices which laid the foundation for some of the great industrial fortunes of later decades. Thereafter the state retained close control over such strategic industries as iron and shipbuilding. More indirectly it guided general economic development through subsidies, tariffs, government banks, and close personal affiliations between the bureaucracy and the *zaibatsu* (the great financial combines). After 1890, however, Japanese industry developed primarily under private ownership and initiative within the general framework of national policy. With due allowance for state intervention and controls and for the pervasive influence of the family system, Japan adhered to private capitalism until the eve of World War II.

War and Industrial Development, 1893–1913.—Between 1893 and 1913 a marked impetus to industrial expansion was afforded by two wars, both of them limited in duration and crowned with victory (see Table 1).

The conflict with China (1894–1895) produced an inflationary boom in Japanese war industries, which carried over into later years under the stimulus of continuing arms expenditures. It also gave Japan the power and prestige to regain her tariff independence (new treaties were nego-

Table 1.—GROWTH OF PRIVATE FACTORY INDUSTRY IN JAPAN PROPER, 1884–1914

Year	Factory opera- tives ² (in 1,000's)	Factory con- sump- tion of coal ³ (1,000's of metric tons)	Output of raw silk (1,000's of kilo- grams)	Output of cotton yarn (1,000's of 400- pound bales)	Net supply of pig iron ³ (1,000's of metric tons)
1884.....	—	147 ⁴	2,697	13	18
1894.....	381	1,093	5,218	292	55
1904.....	526	3,705	7,488	695	133
1914.....	854	8,359	14,084	1,666	474

¹ Source: Japan, Department of Agriculture and Commerce, *Statistical Reports* (annual); Asahi Shimbun-sha, *Nippon Keizai Tōkei Sōkan*, pp. 1213–22 (Tokyo 1930).

² Before 1909, plants employing 10 or more operatives; thereafter, plants employing 10 or more workers of all types.

³ Production plus imports minus exports.

⁴ 1886.

tiated with the Western powers, which rid her of the former 5 per cent limitation on her tariff) and won her an indemnity of £38,000,000 from China. Customs autonomy made possible more effective protection of her new industries; the Chinese indemnity provided her with a gold and sterling reserve with which she adopted the gold standard in 1897. Her public credit now solidly established, Japan proceeded to borrow heavily abroad during the next decade. The proceeds were used mainly to purchase arms, industrial equipment, and materials for further industrial and military expansion, which in turn carried her successfully through the war with Russia in 1904–1905.

Japanese industry now began to assume the basic patterns which were to characterize it for the next 25 years. One branch comprised the metallurgical, engineering, and other heavy industries. These were the industries essential to military strength. Yet they were especially difficult to establish in Japan because of their heavy capital requirements and advanced technology. Here the state assiduously fostered development, itself, for example, launching the big Yawata Iron Works in 1901. Government subsidies also built up the ship construction industry to the point where Japanese yards could turn out 60,000 to 70,000 tons of steam vessels per year after the Russo-Japanese War. In such fields, however, Japan's technical capabilities remained decidedly limited. All except the simplest types of machinery and equipment still had to be imported from abroad. Her deficiency in mineral resources also restricted the mining industry to small proportions except for the production of coal and copper. The output of pig iron reached 243,000 tons, and that of steel 255,000 tons, in 1913. But Japan still imported half of her requirements of the former, and two thirds of the latter.

It was not these protected, high-cost industries which accounted for the substantial growth in Japanese national income and wealth through these decades. This growth came about, first of all, through the expansion and technical improvement of agriculture, which still occupied over half of the working population. Food production, for example, probably increased as much as 40 per cent from 1894 to 1914. In addition, there was a rapid development of numerous industries producing textiles, foodstuffs, pottery, paper, and

other wares for the foreign and domestic market. With this growth and specialization of commodity production came a corresponding increase in the demand for transportation, trade, banking, and professional services. These, too, afforded added employment opportunities for Japan's expanding population.

Unlike the strategic industries, other manufacturing trades mushroomed with little direct assistance from the state. Some were factory industries like cotton spinning, glass, cement, and beer, organized on a fairly large scale with modern equipment and corporate finance. Others were small-scale trades producing textile fabrics, foodstuffs, pottery, wood products, and miscellaneous consumer goods. Many of the latter remained largely on a workshop basis, perhaps with the introduction of some modern equipment—for example, the power loom in weaving. In a number of fields the small plant was linked with a steadily widening market through merchant capitalists, banks, and factories. They supplied materials and credit, and outlets for the finished product. The strength and resilience of Japan's developing industrial system owed much to these myriads of small establishments, coordinated and controlled through a superstructure of large-scale trade and finance. By 1913, Japan boasted nearly 2,000,000 workers in manufacturing. More than half of them were in establishments with less than 10 employees. Over 40 per cent of them were in the textile industries alone.

Textiles thus were the pioneer in the industrial system of Japan, as they had been elsewhere. In this field machine techniques were readily assimilated, capital requirements were small, and at hand were a large market and a reservoir of traditional skills. Raw silk production nearly tripled from 1894 to 1914, as steady improvements in quality enlarged the demand for Japanese silk abroad. Cocoon raising now afforded supplementary employment to one in every three farm families. The cotton industry also increased tremendously after 1890. By 1914 Japanese spinners were equipped with 2,400,000 spindles, and yarn output had reached 1,700,000 bales. Already monopolizing the domestic market, Japanese cotton goods were now spreading steadily through the Far East. As in other countries beginning to be industrialized, in Japan the cotton industry first established its independence in coarse yarns and woven goods. Only later could it enter world competition in the market for finer yarns and fabrics.

Labor conditions in Japanese mining and manufacturing reproduced all the raw evils which had characterized the early stages of the Industrial Revolution in the West. Over half of all factory workers in 1913 were women, many of them young peasant girls from the farms. There were neither factory laws nor trade unions. Hours ran to 10 or 12 or more; accidents and disease took a heavy toll; and the slums and sweatshops of Osaka and Tokyo rivaled those of any city in the world. So high was the turnover of labor that employers had to resort to extensive recruiting in the countryside. Many factory workers, especially women, were housed in dormitories which afforded food, lodging, and a considerable measure of employer control. Despite lack of economic opportunity in Japan's overcrowded agriculture, labor entered the factory only with reluctance.

Industry's Coming of Age, 1914-1929.—

Through the decade before World War I armament and war expenditure imposed a heavy strain on Japan's financial capacity. Large-scale foreign borrowing fostered military and industrial development, but it also burdened the country with increasing debt obligations abroad, which brought growing difficulties in balancing international accounts.

Just as Japan seemed headed for a serious financial crisis, war broke out in Europe. Almost immediately a limitless opportunity developed for exports of Japanese manufactures. War orders poured in, European competitors disappeared from Far Eastern markets, and the merchant marine inherited a large share of the world's carrying trade. Exports built up large foreign credit balances, which were used to sustain a rapid inflation of credit and prices at home. Japanese manufacturing thus embarked on a period of unprecedented prosperity (see Table 2). Factory production increased fourfold in value from 1914 to 1919, while the paid-up capital and reserves of all industrial companies jumped from 944 to 3,264 million yen.

Table 2¹—GROWTH OF FACTORY INDUSTRY IN JAPAN PROPER, 1909-1938²

Year	Factories	Installed electric motors (horsepower in 1,000's)	Employees (1,000's)	Gross production (millions of current yen)
1909.....	32,390	—	1,102	781
1919.....	44,087	992	2,025	6,738
1929.....	60,275	2,600 ³	2,384	7,994
1938.....	113,205	6,290 ⁴	3,718	20,101

¹ Source: Ministry (Department) of Commerce and Industry, *Kōjō Tōkeikyō* and *Statistics of the Department of Commerce and Industry*; other official sources. ² Includes private and public plants employing 5 or more operatives. Statistics of electric motors exclude electric and gas industries; gross production values exclude publicly owned plants. ³ Estimated. ⁴ 1937.

This war boom had two consequences for Japanese industry. The first was a rapid growth in capacity, diversity, and technical maturity. Factories doubled both their employment and their motive capacity from 1914 to 1919. New engineering and chemical industries grew to substantial proportions for the first time. The cotton industry increased its power looms from 55,000 to 110,000, as it expanded the volume and range of fabrics produced for foreign consumption. Steel production passed the 500,000-ton mark; coal consumption rose by 35 per cent.

In 1919 came the postwar financial crisis, with its ensuing fall in prices and stagnation of trade. Now the second and less fortunate aspect of war inflation began to show itself. Many industries and banks found themselves with inflated capital values which could not be supported with the return to more normal conditions. To make matters worse, the authorities attempted to maintain an artificial structure of prices and exchange rates by liberal credit policies and by the use of foreign balances accumulated abroad during the wartime boom. To these circumstances was added the shattering earthquake of 1923. Through most of the postwar decade Japanese industry struggled against deflationary pressures and financial disorders, which culminated in a serious bank crisis in 1927. As a result, this period saw the disappearance of many small banks and industrial firms unable to weather the strain. It brought a pronounced trend toward combina-

tion and cartelization, which strengthened the position of the *zaibatsu*, the great trusts which led the movement. The decade of the 1920's was also the high point of liberal, parliamentary government in prewar Japan. Social issues, including the long-neglected problems of industrial labor, came to the fore. Trade unions began for the first time to assert their power in industries where they could gain a foothold. The first significant reforms were undertaken in the field of factory legislation. (See also sections on *Labor Relations*; *Development of the Modern State*.)

Despite the financial difficulties plaguing many Japanese industries—perhaps because of them—this was also a period of marked technological advance. While agriculture had now virtually ceased to grow, the manufacturing trades moved steadily ahead. Raw silk and cotton goods were still the mainstay of the export trade, and they also provided the major share of industrial employment and income. Raw silk output reached 42,300,000 kilograms in 1929, or three times the 1914 level. Japan now stood second only to the United States and Great Britain as a consumer of raw cotton, with 6,500,000 spindles and a yarn output of 2,800,000 bales.

More significant for the future of Japan was the growth in range and maturity of other, newer industries. The production of electric power and cement, for example, tripled from 1919 to 1929. Steel output had advanced to 2,000,000 tons; coal production was running over 30,000,000 tons a year. Manufacturing output as a whole nearly doubled in the course of the decade (see Table 3). The more advanced types of machinery and equipment still had to be imported, but Japan could now meet her own needs in a wide range of electrical products, industrial machinery, and vehicles.

at the same time increasing the urbanization of the population. Yet in many ways industry remained closely linked with the countryside. It drew its low-wage labor from the nation's overcrowded farms, and its whole structure bore the stamp of the traditional modes of social organization still deeply rooted in rural Japan.

Industries like steel, shipbuilding, and paper developed as highly mechanized, large-scale establishments affiliated with big banks and trading houses. Here modern technology dictated the large plant. In addition, the absence of a broad middle class with capital to invest favored a concentration of control in the hands of great trusts like Mitsui, Mitsubishi, and Sumitomo. Elsewhere the shortage of industrial capital, the lack of advanced skills, and the localized or diversified character of markets encouraged the survival of more than 1,000,000 small plants. Many of these were rural trades offering by-employment to hard-pressed peasant families. Others crowded the growing industrial cities. In 1930 establishments of less than five workers still provided one third of Japan's total manufacturing output and accounted for over half of all persons chiefly engaged in manufacturing activity.

No country has exhibited wider contrasts between large capitalistic enterprise on the one hand, and myriads of tiny workshops still operating largely on the traditional handicraft pattern on the other. Nor has industrialism anywhere produced wider disparities between the immense fortunes piled up by big industrial magnates and the meager living of the masses of workers, small entrepreneurs, and farmers.

Trade, Armament, and Industrial Expansion, 1930-1940.—The great depression of 1929-1932 fell with crushing impact on Japan. The drop in farm prices spread bankruptcy through

Table 3¹—PHYSICAL VOLUME OF OUTPUT IN MAJOR INDUSTRIES OF JAPAN PROPER, 1895-1938
(indices, 1910-1914 = 100)

Year	Manufacturing industries					Mining
	Total	Textiles	Metals and machinery	Chemicals and ceramics	Food products	
1895-99.....	37	41	25	—	80	28
1905-09.....	69	70	61	53	85	68
1915-19.....	160	152	162	186	123	138
1925-29.....	313	270	355	453	193	157
1935-38.....	582	466	950	835	189	227

¹ Source: For the years 1895-1930, indices prepared at Nagoya Commercial College and published in *Hompō Seisan Sūryō Shisū Soran, 1894-1931* (Nagoya 1933). Here these indices are shifted from a 1919 to a 1910-14 base and projected roughly to 1935-38 by means of the indices of the *Oriental Economist*.

By 1930 Japan stood at a midpoint in her transition to an industrial economy. National income and wealth had increased manifold, far outdistancing the growth of population. This had come about through the rapid accumulation of capital and technology, together with the steady redirection of labor and capital toward manufacturing and the services. Agriculture still provided the chief occupation of half of Japan's 29,600,000 workers. Farming and fishing, however, now contributed no more than 20 per cent of the national income, as compared with 35 per cent provided by industry and the balance by the service trades (transport, commerce, the professions, and others).

Japanese industry was thus moving toward a predominant place in the national economy and

the countryside, and the collapse of the United States silk market produced a crisis in the Japanese balance of payments. Deflationary pressures forced the depreciation of the yen in 1931, just as the Japanese Army struck in Manchuria. These two latter events set in motion a train of forces which were to dominate the ensuing decade and culminate in Japan's entrance into World War II.

The depreciation of the yen gave a sharp impetus to Japanese exports, especially exports of cotton and rayon textiles and other cheap consumer goods. Japan's total exports, which now consisted mostly of industrial products, increased tremendously, doubling in quantity from 1930 to 1936. In part, however, the gains from this trade boom were more specious than real, for the lowered value of the yen required that Japan ship a

larger quantity of goods abroad to purchase a given amount of food, raw materials, or machinery. The volume of imports from foreign countries and colonies increased only 38 per cent. With the notable exception of silk, however, the export industries grew rapidly in capacity and output. They also improved greatly the range and variety of goods shipped abroad. (See also section on *Trade*.)

The second stimulus to industrial recovery after 1931 came from the policy of internal deflation pursued by Japan's skillful finance minister, Korekiyo Takahashi. Government spending chiefly took the form of rising expenditures for war, armament, and Manchurian development; it was facilitated by low interest rates and by heavy borrowing from financial institutions. From 1930 to 1936 national expenditures rose from 1,558 to 2,282 million yen, nearly doubling the national debt in the meantime.

Deficit financing thus reinforced the stimulus afforded by the export boom, and Japanese industry forged rapidly ahead. Mining output in-

The metallurgical industries all expanded rapidly, in the process adopting new methods which raised output per worker by about 25 per cent. Steel ingot production increased from 2,300,000 tons in 1930 to 5,200,000 tons in 1936. In the machinery trades, whose output was valued at 1,609 million yen in the latter year, imports were now confined to advanced and specialized types. In fact, a flourishing export market was beginning to develop with the aid of capital investments in Manchuria and north China. Production of coal, cement, glass, and electricity reflected similar gains. The output of soda ash, caustic soda, dyestuffs, and other basic chemicals increased twofold and threefold, or even more. Throughout manufacturing there took place a general growth in the scale of industrial organization and also in the preponderance of the great firms and holding companies which had always dominated heavy industry.

The relative importance of factory industries (including all private plants of five or more workers) in 1936 is shown in Table 4. Metal-

Table 4.—EMPLOYMENT AND NET PRODUCT IN PRIVATE FACTORY INDUSTRY OF JAPAN PROPER, 1936

Industries	Number of workers		Net product value	
	in 1,000's	Per cent	Million yen	Per cent
Textiles.....	1,089	37.8	521	14.3
Machinery, vehicles, etc.....	525	18.3	822	22.6
Chemicals.....	318	11.1	911	25.1
Metals.....	279	9.7	469	12.9
Foodstuffs.....	192	6.7	247	6.8
Ceramics.....	113	3.9	201	5.5
Wood products.....	105	3.7	74	2.0
Printing and binding.....	70	2.4	86	2.4
Other.....	184	6.4	302	8.3
Total, all private factories.....	2,876	100.0	3,633	100.0

¹ Source: Basic data from Japan, Ministry of Commerce and Industry, *Kōjō Tōkeihyō*, 1936.

creased 30 per cent from 1930 to 1936; manufacturing output, 63 per cent. Wage rates recovered only slowly from depression levels because of the pressure on the labor market exerted by the stagnation of Japanese agriculture and the mechanization of many industries. Business profits reached boom levels, however, and provided huge sums for the expansion and re-equipment of Japan's major industries.

The progress of different sectors of Japanese industry was nevertheless uneven. The textile trades, as well as other industries producing consumer goods for foreign or domestic markets, made substantial gains in their scale of production, equipment, and organization. For example, the adoption of high-draft ring spinning and of automatic power looms in the cotton industry increased output per worker severalfold in the decade before 1936. Especially noteworthy was the sudden growth of the rayon industry, in which production jumped from 16,662 tons in 1930 to 125,420 tons in 1936. The woolen industry likewise won a substantial foothold in foreign markets.

It was chiefly the machinery, metallurgical, and chemical industries, however, which grew rapidly under the stimulus of armament spending and industrial construction in Japan and the overseas territories. While consumer goods production rose 33 per cent from 1930 to 1936, the output of producer goods jumped 83 per cent.

lurgy, machinery, and chemicals now accounted for 1,122,000 of Japan's 2,876,000 factory workers. They furnished as much as 2,202 million of the 3,633 million yen of net product (value added by manufacture).

While the armament business, government tariffs, and subsidies had contributed heavily to the large output and high prices which now characterized these industries, their new importance reflected a trend toward industrial diversification long evident in Japan. This trend doubtless represented the natural course of Japan's economic development, now reinforced by the stagnation of agriculture and by the increasing resistance to Japanese textile exports abroad. In the 1930's, however, it was greatly accelerated, and twisted toward the military ends of armament and empire building. As a result, Japan's industrial capacity and her capacity for waging war were enlarged. The flush of industrial prosperity, however, brought comparatively little gain in the Japanese standard of living. The consumption of civilian goods just about kept pace with the growth of population.

By 1937 Japan had reached virtual full employment. A brake had to be applied unless serious financial difficulties were to be invited. Military expansion, once begun, however, was not to be stopped. The outbreak of war in China was the signal for increased armament and military expenditure.

Immediately two difficulties began to appear. Continuing imports of war materials on a large scale weakened the yen. This led to the imposition of drastic exchange controls which seriously impaired the textile and other civilian industries requiring materials from abroad. In the domestic field as well, the acceleration of war preparations began to cut into the requirements of the civilian economy. The government was thus forced to spread a network of controls over investment, the allocation of materials, wages, and prices. By 1940, Japan was already devoting 17 per cent of her gross national product to war purposes. When the Japanese Navy struck at Pearl Harbor, the groundwork had been laid for full-scale industrial mobilization.

Japanese Industry at War, 1941-1945.—Japan entered World War II with an impressive record of industrial preparation. During the previous decade she had created virtually from nothing her aircraft, motor vehicle, tank, aluminum, and machine tool industries. By 1941 she was producing annually 5,000 aircraft, 48,000 motor vehicles, and nearly 500,000 tons of steel shipping. Steel ingot production was running at 6,800,000 tons; coal at 55,600,000 tons. Electric generating capacity had doubled since 1931. Immense stockpiles of equipment and raw materials, including a two-year reserve of oil, had been accumulated. Feeding the home industries of the Japanese islands were the controlled resources of Manchuria and north China. These were now developed to the point where they furnished a major part of Japan's requirements of iron, coking coal, salt, and certain other minerals.

With all these gains Japan still possessed hardly 10 per cent of the industrial potential of the United States. Moreover, she remained basically dependent on overseas supplies of oil, rubber, iron, bauxite, tin, and other strategic metals. The decision to strike at Pearl Harbor was therefore a desperate gamble on a war of limited liabilities. By seizing the rich regions of Southeast Asia and by establishing a defensive perimeter, Japan's military leaders hoped to win the resources with which to hold out until war weariness in the United States or a favorable turn in the international situation should enable her to retain significant gains.

This Japanese war plan may explain the lack of decisive measures to increase industrial capacity and production during the first year of hostilities. Not until the military reverses of late 1942 was industrial mobilization placed in high gear. Emergency controls were tightened under a Munitions Ministry established in 1943. Key industries—aircraft, shipping, coal, and metals—were singled out for concentrated effort. Direct outlays on war and munitions, which stood at only 31 per cent of the gross national product in 1942, were raised to 52 per cent in 1944. Some 9,500,000 persons were now engaged in factory industry and construction. This was 30 per cent of the nation's entire civilian labor force.

In the technical realm the war effort at its peak was impressive, especially in view of Japan's late entry into the industrial field. In 1944 aircraft production was raised to 26,364 planes, and over 2,000,000 tons of warships and steel merchant vessels were launched. Steel capacity was enlarged to 14,000,000 tons. Japanese fighter planes and other equipment proved the equal of those of any other country in many aspects of design and performance.

As early as 1943, however, the inherent weaknesses of Japan's industrial war effort were becoming evident. Its scale was necessarily limited by the meager Japanese standard of living, which could not be sharply reduced without impairing civilian efficiency and morale. Yet consumer expenditures in 1944 dropped 30 per cent from the 1940 level. Meanwhile, the lack of a large reserve of skilled workers created acute bottlenecks in essential industries. Overhead direction of industrial mobilization was crippled throughout the war by diffusion of responsibility. Sharp conflicts prevailed among separate ministries and between the government and business interests. Most importantly, Japan's basic vulnerability to sea blockade began to manifest itself in 1943, as Allied attacks on Japanese shipping began to cut off the inflow of strategic materials.

Peak production of finished military products was not reached until late in 1944. Already, however, the basic industries had begun to decline. Supplies of oil, aluminum, iron, and coal dwindled as submarine and air blockade progressively closed off the southern regions, and then even north China and Manchuria. Both imports and stocks of crude oil were virtually eliminated by the last quarter of 1944. Finished steel production had dropped 50 per cent. In short, Japan's war economy was crumbling at its foundations.

In the spring of 1945 came devastating air attacks on the home islands. These destroyed 40 per cent of the area of 66 cities, making 30 per cent of the urban population homeless. By July 1945, industrial output had declined to 40 per cent of the 1944 peak, and the Japanese will to continue resistance was broken. The atomic bomb and the Soviet Union's entry into the war were the *coups de grâce* which brought surrender.

Postwar Industrial Recovery and Reform.—With the war ended, Japan faced formidable tasks of industrial reconstruction. Great industrial areas lay in ruins. Foreign trade was at a standstill. The colonies were gone. The merchant marine lay at the bottom of the ocean.

Still more serious was the cumulative effect of Japan's war effort in dislocating the structure of peacetime industry and trade. The defeated nation now found itself with a surplus of idle war plants. But its cotton textile industry—to cite one civilian industry—was reduced to 2,150,000 spindles. The remaining 10,000,000 spindles of its 1937 plant had been scrapped, damaged, or converted to war uses. Raw materials and food were urgently needed from abroad. Yet Japan had nothing with which to pay for them. To add to the demoralization, the country's finances were in a chaotic state. As a result of deficit spending by the government and other inflationary stimuli, wholesale prices rose tenfold during 1946 and 1947. Especially acute was the shortage of food in the cities. Operating at only 31 per cent of its 1934-1936 level in 1946, Japanese industry faced a painful uphill struggle (see Table 5).

The Allied authorities, during the first two years of the occupation, were more concerned with Japan's disarmament and democratic reform than with industrial recovery. An interim reparations program was drawn up and approved by the Far Eastern Commission in 1946. It called for the removal from Japan of industrial plant capacity in excess of the nation's peacetime needs,

Table 5—INDUSTRIAL PRODUCTION IN JAPAN,
1944–1952
(1934–1936 = 100)

Year	Total	Manufacturing		Mining
		Durable	Nondurable	
1944.....	179	320	51	139
1946.....	31	37	22	52
1948.....	59	79	36	83
1950.....	94	119	69	102
1952.....	136	174	103	120

¹ Source: Economic Council Board, *Japanese Economic Statistics*, July–August 1953.

and its distribution among the Allies as compensation for war damage. Meanwhile, two principal steps were taken by the supreme commander for the Allied powers to democratize the control and operation of Japanese industry: the government was directed to legalize and encourage trade unions and collective bargaining (see section on *Labor Relations*), and a determined attack was launched on the monopolistic structures of the great *zaibatsu* combines. This latter undertaking was to achieve only limited results, owing to its inherent complexity and the lack of positive support in Japan. The leading *zaibatsu* families were largely shorn of their wealth and power; many nuclear companies at the center of the combines were dissolved or deconcentrated; and lateral ties among the remainder were weakened by the temporary purge of business executives and by restrictions on intercorporate shareholdings and interlocking management. By 1951, however, new business blocs were beginning to re-form around the big banks. An antimonopoly law, patterned on United States antitrust laws and forced through the Diet in 1947, was emasculated by amendments in 1949 and 1953.

Industrial recovery proceeded only slowly through the early occupation years. Except for emergency imports of food and essential materials, the Allied authorities placed responsibility for economic rehabilitation mainly on the Japanese government. But successive Cabinets proved themselves weak and dilatory in acting to restore the economy to solvency. By 1948 exports were still hardly 10 per cent of their prewar volume. Now the argument for more decisive stabilization measures was reinforced by growing international tension in the Far East, which highlighted Japan's weakness. Accordingly, the United States government took the lead in re-examining the reparations issue, and removals of industrial equipment for this purpose were discontinued in 1949, before they had gone beyond the token stage. At the same time, the Japanese government was required to balance its budget, and to tighten controls over prices, credit, and wages. With inflation stopped, the economy quickly began to show greater strength and stability. The outbreak of the Korean War in June 1950 gave a new stimulus to industrial production. Again, however, powerful inflationary pressures were revived, and soon created fresh difficulties in the export field.

By 1953 Japanese industry was producing 50 per cent more than in 1934–1936. On the surface this was an impressive gain. Yet the prospect was clouded by one grave weakness—the lagging recovery of exports. Industrial revival (see Table 5) had been built on a level of imports which far outran exports and were financed only

by huge expenditures of United States government funds in Japan (see section on *Trade*). Some of Japan's export difficulties lay abroad beyond her control. But her export industries were also handicapped at home by ineffectual controls over inflation, which raised costs and diverted resources to other uses. Although capital investment was at high levels, too little was going into the replacement of inefficient, obsolete equipment in export trades whose competitive strength in world markets was still weak.

As the postwar decade drew to a close, it appeared that Japan had yet to resolve the basic issue of how she was to prosper in the changed postwar world. With her population approaching 90 million, she depended more than ever on her industrial economy. A people of such enterprise and skills might be expected to resume the search for economic opportunity through building on a still larger scale one of the great workshops of the world. How well they would succeed depended on whether they could gain ever wider access to overseas materials and markets.

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7. TRADE. This section treats the trade of Japan as it developed in (1) the domestic market, (2) the foreign market before World War II, and (3) in war and defeat.

Growth of the Japanese Market.—Japan's economic development in modern times illustrates Adam Smith's famous dictum that division of labor, the key to industrialization, is limited by the extent of the market.

During the Tokugawa shogunate (1603–1867), Japan's once flourishing maritime trade in the China seas was interdicted by the country's military dictatorship. For more than 200 years the nation was walled off from all but the most meager contacts with the outside world. In 1637 the authorities decreed that no Japanese might leave the country and return on pain of death. Seclusion was reinforced by a ban on the building of any ship with a capacity of more than 50 tons.

Internal commerce was also cramped and confined by political regulations, lack of transport, and the general self-sufficiency of preindustrial, peasant life. As late as 1868 there were virtually no highways in Japan worthy of the name. Nor were there even many wheeled vehicles of any description. The cost of transporting rice by land doubled its price in 10 to 20 miles or less. Bulk cargoes went chiefly by sea, but the 600-mile passage by junk from Tokyo to Kyushu was a hazardous one consuming a month or more. Trade was further limited by many toll barriers and by various restrictions on occupation, residence, dress, and the like.

In the latter half of the Tokugawa period

there appeared, it is true, a quickening of commercial activity and a rise of specialized handicraft production for local or interregional exchange. This growth of merchant capitalism, indeed, had much to do with the decay of the old semifeudal regime and its overthrow in the 19th century. Only with the reorganization of political power and the abolition of multifarious restraints on trade could the new forces of capitalism and nationalism find full expression.

The Meiji Restoration in 1868 ushered in a period of intensive modernization under the new national government. The remnants of feudal political organization with its semiautonomous territorial clans were abolished in favor of a centralized nation-state. The country was thrown open to a flood of Western influences. Within Japan the new government proceeded to establish a national system of taxation, banking, and currency; the beginnings of universal, primary education; a modern code of commercial law; new warehouses and commodity exchanges facilitating trade; a national network of posts and telegraphs; and, not least in importance, an expanding system of railways, shipping, and trunk highways.

One contribution of the state to economic modernization was its early encouragement of foreign trade, especially imports of machinery and equipment. Its most signal contribution, however, was to create and maintain a framework for a unified national market through such measures as those indicated above. Together these developments afforded the basis for a rapid expansion of Japan's productive power in subsequent decades and for a corresponding growth of commerce.

This structural framework for national economic development was not, of course, built overnight. By the turn of the century, however, the foundations had been laid. Between 1897 and 1927 railway freight traffic rose from 8,600,000 to 101,000,000 tons; shipping cargoes entered and cleared in coastwise trade reached 93,000,000 tons; and the number of animal-drawn carts licensed to haul goods multiplied fourfold. The index of the physical volume of imports from foreign countries (1913=100) meanwhile advanced from 45 to 200; the export index, from 32 to 175. These figures point to a tremendous increase in the exchange of goods and services produced for the market.

The expansion of Japanese commercial activity had two aspects. First, it reflected, and made possible, a steady growth in per capita production of agricultural and industrial products and services. This resulted from the introduction of capitalistic forms of production, especially in nonagricultural pursuits. Substantial gains in output per worker came about through the application of science, machinery, and modern business forms. At the same time population increased rapidly, rising from 38,000,000 to 69,000,000 between 1885 and 1935.

To what extent population growth actually expanded the national market is conjectural. It enlarged the demand for basic necessities like rice and cotton clothing, but it also restricted the market for other imported and domestic manufactures by limiting the advance of per capita output and levels of living. By any Western standard the Japanese internal market remained strikingly poor, mainly because of the severe pressure of population, accentuated by large expenditures on

armament, colonies, and strategic industries. Nevertheless, from available evidence it would appear that Japan's total national income and production at least quadrupled from 1885 to 1935.

In the second place, as an essential condition of this economic growth, production was increasingly commercialized for sale in the market. The old localized household and village economy of traditional Japan lingered on, especially in the more remote countryside. More and more, however, it gave way to a complex specialization of occupations, of regions, and of production processes, all tied together in expanding circuits of exchange. Some of these circuits represented primarily the exchange of goods and services in the domestic market; others involved wholly or in part the import of materials and equipment from abroad, paid for through exports.

The result was a pervasive spread of a money economy. The population of Japan's swarming cities naturally supplied most of their requirements through purchasing goods and services on the market. And by 1935 one in every three Japanese lived in a city of 30,000 or more. Even the Japanese farmer had come by this time to provide for two thirds of his family consumption of goods by purchasing them with cash income. The creation of capital goods, now a significant share of the national product, also meant production for the market, except as the farmer, the petty merchant, or the industrialist used his own labor to improve his land, buildings, and tools.

Both the specialization and expansion of production, then—two interlocking processes—steadily enlarged the sphere of market organization and the volume of exchange transactions in modern Japan.

While this widening of markets is commonly recognized as a necessary feature of Japanese industrialization during the past century, it is often thought of primarily in terms of overseas trade. Attention is centered on the rapid growth of the foreign market for Japan's major industries, with the implication that the home market failed to develop *pari passu*—indeed, was of little significance in industrialization. This is a gross misinterpretation of the historical facts, which fails entirely to account for the substance and momentum of Japan's economic modernization.

It is true that foreign trade has played a peculiarly important role in Japanese development since 1868. No country has been more suddenly transformed through contact with the outside world, or has built up a large complex of industry more dependent on those contacts. The nature of this dependence and its extent are examined below.

Before turning to foreign trade, however, it is important to place it in its proper perspective in Japanese economic life. Throughout the modern period the commerce of Japan has been predominantly the exchange of goods and services *within* the country. The home market has far outweighed the foreign market.

Except for shipping and certain financial operations, this is necessarily true of most services produced in any economy—the movement of goods and people and various private and public professional services, which are by nature non-exportable. Together they accounted in Japan for 20 to 30 per cent of all gainful employment and 50 per cent or more of all income produced

between World Wars I and II. The production of farm commodities, which probably doubled in the half century ending in 1935, was likewise geared almost wholly to the domestic market, with the conspicuous exception of sericulture. Certain sectors of Japanese industry were heavily oriented toward foreign trade; others, not at all. Japanese manufacturing as a whole (eliminating double counting of items) disposed of no less than 65 to 75 per cent of its product at home toward the end of this period.

The relative magnitude of Japan's foreign and domestic market is best expressed for the entire economy by the ratio between (1) the value of merchandise exports to foreign countries and colonies, and (2) the total value of all goods and services produced in Japan. Throughout most of the period 1914-1938 this ratio averaged about 20 per cent. The relationship fluctuated from year to year; in 1930, for example, total exports (including those to Korea and Formosa) came to 1,828 million yen, while the national product was valued at about 10 billion yen. Over the 25-year period, however, both series appear to have maintained a fairly consistent ratio of 1:5. Nor would the inclusion of certain exported services materially alter the conclusion. Evidently the prewar Japanese economy as a whole expanded more or less in proportion to the growth of foreign trade after 1914.

Thus the spectacular rise of foreign trade described below should not be allowed to obscure the fact that it was part of a more general process of expansion characterizing all parts of the Japanese economy in varying degrees. Indeed, foreign trade could not have increased so rapidly without a concurrent growth of domestic production and purchasing power. Some imports were purchased every year to supply such export industries as cotton goods with raw materials and equipment. In effect they were re-exported. But the bulk of the imports of food, raw materials, and manufactures went into home consumption. In 1936, for example, total imports from foreign countries, Korea, and Formosa were valued at 3,599 million yen. Offsetting these imports were exports of similar types, or imported materials embodied in export manufactures, amounting to about 1,100 million yen. The balance of imports, 70 per cent of the total, may be said to have been retained (net) for domestic use.

Foreign Trade of Prewar Japan.—While the growth of Japan's foreign commerce after 1868 was only one phase of her general development, it played a peculiarly strategic role. In a real sense, the whole increase of Japanese national income and wealth in modern times was founded upon expanding contacts with the outside world. Equally, the extension of her political empire in Asia (and its collapse in World War II) was closely associated with the growth of foreign trade, the ambitions which it fostered, and the dependence which it created.

During the early decades of the Meiji period (1868-1912), Japan's foreign commerce was significant chiefly as a newly opened highway of communication over which all sorts of new stimuli and new knowledge flowed from the West into the once isolated country. Foreign trade and foreign traders brought in industrial machinery and equipment, ships and munitions, and Western textiles and other consumer goods, as well as new techniques of industrial and financial

organization. Through this channel, as well as through foreign travel and study, the Japanese began to import and to assimilate the industrial arts which were to revolutionize a large part of their traditional economic life in the next 75 years.

Soon the second potentiality of foreign trade for Japan commenced to assume growing proportions. Most of the basic natural resources necessary for modern industry were lacking in Japan—notably, iron ore, coking coal, petroleum, and other essential minerals. In addition, as her population grew, her agriculture was increasingly unable to provide food, cotton, and other agricultural raw materials to sustain her growing industries. With the steady progress of industrialization, Japan soon reached a degree of national dependence on overseas materials that was exceeded by few nations. By 1930 net imports (imports minus exports) from foreign countries, Korea, and Formosa furnished the following percentages of Japanese consumption: cereals, beans, potatoes (grain equivalent), 13 per cent; fats and oils, 41 per cent; nitrogen fertilizer materials, 20 per cent; hides and skins, 75 per cent; petroleum products, 79 per cent; iron and steel (iron content), 85 per cent; lead, zinc, tin, and aluminum, 70-100 per cent; cotton, wool, rayon pulp, and rubber, 100 per cent. With a few exceptions like raw cotton, these imports did not so much replace as supplement the growing output of Japan's own farms, forests, and mines.

Table 1 summarizes the growth and changing character of Japan's international trade (excluding trade with her colonies) over three decades. Several broad characteristics may be noted.

Imports and exports, valued at only 11 and 16 million yen, respectively, in 1868, both passed the 100-million yen mark on the eve of the Sino-Japanese War (1894-1895). During the next 20 years they increased threefold and fourfold. World War I brought further gains, which were carried over through the postwar decade. (See also section on *Industrial Development*.)

A fresh impetus was given by the depreciation of the yen in 1931. In the ensuing trade boom, between 1930 and 1936, exports advanced from 1,470 to 2,693 million yen; imports, from 1,546 to 2,764 million yen. Import prices rose more rapidly than export prices, so that the terms of exchange moved against Japan. By 1936, however, Japan was importing more than twice as much as in 1913 and exporting three to four times as much. Except in the years 1915-1918, imports exceeded exports in value throughout this period. The trade deficit was offset by net earnings on shipping and foreign investments, by capital and gold movements, and by other invisible items in the balance of payments.

The figures in Table 1 refer only to trade with foreign countries. In addition, Japan built up a large source of food supplies in Korea and Formosa, paying for them with manufactures sold in these protected empire markets. If this colonial exchange is included, total Japanese imports from overseas amounted to 3,599 million yen in 1936, and exports to 3,508 million yen.

The changing composition of Japan's exports over these decades reflected the world economy of the times and the growing capabilities of her industries. For 50 years raw silk (classified as a semimanufacture in Table 1) held the lead. Japanese silk early won a preponderant place in

Table 1—FOREIGN TRADE OF JAPAN PROPER, 1893-1936

Total Trade	Exports			Imports		
	1893	1913	1936	1893	1913	1936
Value in yen (millions).....	90	632	2,693	88	729	2,764
Index of physical quantity (1913=100).....	21	100	356	24	100	226
Distribution by Classes ²	Percentages					
Food and tobacco.....	20	10	8	23	17	8
Raw materials.....	10	8	5	22	48	63
Semimanufactures.....	41	52	27	20	17	17
Manufactures.....	25	29	58	33	17	11
Distribution by Regions; Exports to and imports from:						
North and South America.....	34	30	27	7	17	38
United States.....	31	29	22	7	17	31
Asia.....	30	43	51	42	48	38
China ³	26	30	27	30	13	14
Europe.....	32	23	11	47	30	12
United Kingdom.....	6	5	5	32	17	3
Other Regions.....	3	3	11	4	5	12

¹ Source: Basic data from Japan, Department of Finance, *Annual Returns of the Foreign Trade of Japan*.

² Omitting "miscellaneous."

³ Including Hong Kong, Kwantung Leased Territory, and (in 1936) Manchukuo.

the great American silk market. From 1920 to 1930 this single item furnished 36 per cent of Japan's total export trade. Its contribution toward payment of foreign products consumed in Japan was even more important than this figure would indicate, for, unlike cotton goods exports, no part of the proceeds of silk sales had to be used to recover the cost of imported materials used in the export industry.

When silk prices collapsed in 1930-1931 the yen fell drastically in value—from \$49 in U.S. currency in 1930 to \$.28 in 1932. This gave a sharp stimulus to exports of cotton textiles, which had been expanding steadily since 1900 in Far Eastern markets. Aided by technical improvements, and by currency depreciation unmatched by corresponding increases in wages and other costs, Japanese cotton goods and other cheap manufactures spread rapidly through world markets. By 1936 Japan had become the world's premier exporter of cotton piece goods, with shipments of 2,710,000,000 square yards valued at 473 million yen. Other leading exports were as follows (in millions of yen): raw silk, 393; rayon piece goods, 149; machinery, 139; pottery and glass, 74; canned foodstuffs, 71; and a wide variety of other textiles, toys, chemicals, metal wares, and wood products.

Industrialization brought equally striking changes in Japan's import trade. During the early decades her purchases abroad were distributed over a wide range of foodstuffs, industrial materials, machinery, and other Western manufactures. Increasingly, however, as Japanese industry gained in capacity and maturity, it ousted foreign manufactures from the domestic market. Imports of consumer manufactures were restricted by high Japanese tariffs: machinery imports became confined more and more to advanced and specialized types still purchased more

cheaply in the West. By 1913 cotton, metals, and other raw materials already constituted one half of Japan's total imports (see Table 1). Thereafter the principal growth took place in imports of these industrial materials, together with rice, sugar, and other foodstuffs secured from colonies and foreign countries. In 1936, at the peak of Japan's prewar trade boom, her chief purchases from foreign countries were as follows (in millions of yen): raw cotton, 850; iron and steel, 231; wool, 201; petroleum products, 183; machinery, automotive vehicles, and instruments, 156; fertilizer materials, 145; non-ferrous metals, 141; wood and wood products, 122; and rubber, 73.

These changes in the composition of Japanese foreign trade resulted in corresponding shifts in its distribution among the principal regions of the world, as shown in Table 1. Throughout the prewar period this trade preserved a dual character. On the one hand, Japan sold to the West (mainly to the United States) one major industrial material, raw silk, together with a variety of simple manufactures like pottery and toys. The latter, however, were heavily restricted by high tariffs which tended to rise as Japanese competition became more severe. In Asiatic markets, meanwhile, Japan came to occupy increasingly the typical position of the industrial supplier, selling cheap cotton and rayon goods, metal wares, and other manufactures in exchange for rice, beans, coal, oil, rubber, and numerous other raw materials. By 1936 half of her exports to foreign countries were being marketed in Asia—as much as 63 per cent, if exports to Korea and Formosa are included.

Nevertheless, Japan remained heavily dependent upon the West for some of her most vital imports and for markets where she could earn the foreign exchange to pay for them. Here

she continued to purchase essential machinery and vehicles, as well as large amounts of cotton, wool, oil, steel, and other basic materials. The United States, in particular, still played a major role in Japanese trade, taking more than one fifth of her exports and supplying nearly one third of her imports. Japan's trade and armament boom from 1931 to 1936 so swelled her purchases of American materials and equipment that by 1936 she was absorbing half of all United States exports to Asia—more than were sold in all of Latin America.

Japan's Trade in War and Defeat.—From the foregoing survey it is apparent that foreign trade played an indispensable role in Japan's rise as an industrial power. No country derived greater benefit from the fortunate circumstance that the world economy of 1880–1935 was an expanding economy organized on a fairly free and competitive basis. Especially important for Japan was the system of multilateral trading relations in which a nation could buy and sell according to its economic advantage, settling its credits in one region against its debits in another.

The spread of trade and exchange restrictions in the 1930's, and especially the sharp increase in tariffs and quotas directed specifically against Japanese goods, was an ominous portent of the future. In part, however, Japan could only blame herself if a sudden, sharp influx of her cheap manufactures into the national or colonial markets of industrial nations struggling with depression provoked defensive measures. In any case, these measures failed to prevent a great expansion of Japanese trade, which contrasted favorably with the relative stagnation of economic activity elsewhere.

Japan thus had a special stake in preserving a free world economy. As she became a great trading power, however, she was exposed to the insecurities of this world economy, with its booms, depressions, and currency disorders. More important in the eyes of her military leaders, she found herself heavily dependent on markets and materials controlled by the other great powers, particularly the United States and the British Commonwealth. This was unacceptable to the militarists. Their dreams of Japanese hegemony in the Western Pacific required for their fulfillment the creation of a great east Asian bloc securely under Japan's domination and capable of satisfying her economic requirements, at least insofar as the sinews of war were concerned. With the seizure of Manchuria in 1931, national policy was directed increasingly toward the realization of this aim.

From 1931 to 1936 Japan found it possible to expand her armaments and extend her conquest of China while simultaneously enjoying a boom in foreign trade throughout the world. The latter fed the former, as evidenced in the huge import of war materials from the United States. After 1936, however, Japanese resources were fully employed (see section on *Industrial Development*). Continued deficit financing of war industry and colonial development brought rising inflation and progressive dislocation of civilian production and trade. Total imports and exports continued at a high level from 1936 to 1939. The trade with occupied China, Formosa, and Korea even registered large increases. But trade with countries outside this yen bloc began to dwindle in the face of growing exchange difficulties. Imports were diverted sharply to oil,

steel, and other strategic materials, in which the yen bloc remained seriously deficient. By 1940 food purchases from all overseas sources had fallen by one quarter, and shipments of raw cotton and wool by one half. The crisis came the following year, when the United States, Great Britain, and the Netherlands, aroused by Japan's aggressive military actions, at last embargoed all trade with her, pending a political settlement.

In World War I, Japan remained a neutral in all but name, reaping large profits from the trading opportunities it afforded. In World War II she cast the die in favor of a desperate bid for empire in east Asia. The result in the end was to destroy the whole structure of foreign trade upon which she had built her economic life, and to leave her a defeated and impoverished nation surrounded by neighbors similarly impoverished by her gamble.

Japan's war economy possessed hardly 10 per cent of the potential of her principal antagonist, the United States. And it was fatally dependent on overseas shipments of critical war materials.

Manchuria and north China had been developed to supply an important part of the Japanese deficit in coking coal, iron, salt, and foodstuffs. But oil, bauxite, rubber, manganese, chrome, nickel, and a dozen other strategic items had still to be brought in from the distant southern regions now overrun by the Japanese armies. Almost immediately these exposed sea lanes to the south came under attack from Allied submarines and aircraft. As the attack gathered weight and momentum through 1942 and 1943, the Japanese merchant fleet began to suffer relentless attrition.

As early as 1943 the peak output of basic materials in Japan was passed, and thereafter production and stocks steadily dwindled. By the second half of 1944, imports of four essentials had declined to the following percentages of 1943 shipments: coking coal, 35 per cent; iron ore, 28 per cent; bauxite, 17 per cent; crude oil, 9 per cent. Imports of rice, sugar, and textile fibers also approached the vanishing point. Half of all military supplies shipped from Japan to armies in the field were lost at sea during 1945. By the end of the war only 1,400,000 gross tons remained of the 6,000,000 tons of steel ships of 100 gross tons and over with which Japan had entered the war, despite the construction of 4,100,000 tons in the meantime. The United States Strategic Bombing Survey concluded that by August 1945 the interdiction of overseas materials alone would have reduced war production in Japan to 50 or 60 per cent of the 1944 level, even without air attack directly on the home islands. The latter largely destroyed Japan's war economy twice over and finally demoralized the nation to the point of surrender.

The early postwar years witnessed the slow and painful rehabilitation of the Japanese economy (see section on *Industrial Development*). The Allied occupation authorities faced the immediate necessity of importing large quantities of food to meet the critical shortage in the cities, as well as raw materials to restock the empty pipelines of industry. Beyond this it was evident that no long-term reconstruction of a politically stable and economically viable Japan could take place without restoring her access to world markets and supplies. Yet her ability to pay for imports was virtually nonexistent as the occupation began. Her export industries were greatly impaired in capacity and efficiency. Her

sheltered colonial market had disappeared. And elsewhere her structure of prewar trading relationships lay in ruins.

The revival of Japanese industry was closely correlated with the revival of the import trade which furnished its principal materials. By 1948 imports still totaled only 18 per cent of their 1934-1936 volume. Thereafter they rose year by year, reaching 48 per cent in 1951 and about 75 per cent in 1953. Half of their total value in 1953 was divided about equally between textile fibers (mainly cotton) and foodstuffs. The remainder consisted of machinery, fertilizers, coal, oil, and other industrial materials. The United States and Asia each supplied about one third of the total.

The crucial weakness of Japan's postwar recovery was the fact that even at this reduced level of imports she was living well beyond her means. United States government funds paid for 62 per cent of Japanese imports from September 1945 to June 1950. Some \$1,800 million was devoted to the purpose. Thereafter such aid was rapidly tapered off, and it ended in 1952. This was possible, without economic collapse, only because the Korean War brought a stream of dollars to Japan in the form of procurement contracts and troop spending. Meanwhile, commercial exports continued to lag far behind imports. While they rose steeply in 1949 and 1950, they were still only 35 per cent of their 1934-1936 volume in 1953. In that year they amounted to only \$1,275 million, as against imports of \$2,410 million. This huge gap was largely covered by \$809 million of United States offshore procurement payments and troop spending in Japan. Even then the remaining deficit reduced foreign exchange reserves to dangerously low levels.

These subsidies and windfall gains could not be expected to continue. The Japanese thus faced the necessity in 1954 of finding new export outlets on a large scale or of drastically reducing their standard of living. The silk trade, so long the mainstay of the economy, had now almost disappeared. Although Japan led the world in cotton goods exports in 1953, her shipments ran to only 914,000,000 square yards, as compared with 2,710,000,000 square yards in 1936. Exports to Asia nearly balanced imports and, as in 1936, comprised half the total. In volume, however, they were much reduced, especially because of the decline in sales to Korea and Formosa, and the virtual disappearance of the mainland China trade. The general imbalance in the commodity accounts was especially acute in trade with the United States and other dollar areas. Here receipts fell short of payments by \$538 million in 1953.

Japan's unsolved trade problem was twofold. In the sharpening competition for world markets she could hardly hope to meet her needs unless she cut her nonessential imports to the bone, curbed inflationary tendencies at home, and increased the efficiency of her export industries. Even this would be inadequate, however, unless progress could be made in stabilizing the Far East and in restoring a freer structure of world trade. Though loyally abiding by the United Nations embargo on shipping strategic materials to Communist China, many Japanese felt that their future was hopeless without access to Chinese markets and raw materials. Moreover, the opportunities required by Japan if she was again to prosper depended on the reconstruction of an international economy based on a durable peace.

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8. LABOR RELATIONS. Although the Japanese labor movement dates back to the 19th century, it did not become a strong force in Japanese society until after Japan's surrender to the Allied powers in 1945. The postwar labor movement was nevertheless conditioned by its past.

During the late 19th and early 20th centuries Japan was rapidly industrialized under the aegis of a government modern in form but still largely feudal in spirit. In this process a large industrial proletariat was created. By 1930, 36 per cent of the gainfully occupied population was engaged in commerce and industry as against 51 per cent in agriculture and fisheries. Before World War II, however, the industrial working class, despite its large numbers, played on the whole a passive role in the economic, social, and political life of the nation.

There were several reasons for this situation, one basic reason being economic. Owing to the rapid increase in population and the limited supply of arable land, Japanese industry, despite its steady expansion, was never able to absorb all the surplus labor of the countryside. Since the supply of labor always exceeded the demand, labor's economic bargaining power was weak. This condition, which is paralleled in other Asiatic countries and which still exists, helps to explain why Japanese labor has sought to improve its status through political as well as through economic action. The structure of Japanese industry also militated against successful efforts at labor organization. A few huge, semimonopolistic family concerns (the *zaibatsu*) dominated industry and trade, while at the other end of the scale were thousands of tiny workshops employing less than five workers; medium-sized enterprises were relatively few in number. Hence labor unions found that most employing establishments were either too big to challenge with success, or too small to organize effectively. Wages remained low, and although the 20th century saw a gradual increase in real wages and in workers' living standards, this was not commensurate with the increase in national income.

Another reason for labor's passivity was social. Habits of thought and action derived from the feudal period, when carried over into modern industry, resulted in a high degree of paternalism. According to prevailing concepts, the proper relationship between employer and employee was one of mutual loyalty resembling the relationship between a feudal lord and his faithful retainers. The employee was expected to obey his employer dutifully and to accept his guidance not only on the job, but also in moral and political affairs; in return, the employer accepted an obligation to provide for the welfare of his employees. While this ideal pattern was not always realized in practice, it did something to mitigate the social evils which usually accompany the growth of industrialism. It also discouraged individual initi-

ative on the part of employees and the formation of group loyalties conflicting with the older concept of loyalty to persons. The strongly entrenched family system played a similar role as a focus for loyalties which in a more individualistic society might have attached themselves to trade unions or to the working class as a whole, and as a cushion against the evils of industrialism. A man who lost his job, or who could not live on his earnings in the city, could usually return to his native village and eke out a living with the aid of his relatives. Thus for many workers the family system provided a refuge which, however unsatisfactory, was safer and surer than the problematical gains of organizing to better their condition.

The principal obstacle to the growth of labor organization, however, was the attitude of the government, a narrowly based oligarchy essentially authoritarian in character. Aiming at national greatness rather than at national welfare, Japan's rulers sought to indoctrinate the masses with unquestioning loyalty to the state and sternly discouraged all movements of a popular or democratic nature. Trade unions were regarded as suspicious, if not subversive, and attempts to organize a union were made punishable by imprisonment under a law enacted in 1900. While this law was not always strictly enforced in later years, other laws, notably the Peace Preservation Law of 1925, rigidly circumscribed labor's activities and conferred broad powers on the police. Trade unions were kept under close surveillance; many strikes were broken by police action, unions were dissolved, and labor leaders were imprisoned. During the 1920's some attempts were made to set up impartial machinery for adjusting labor disputes, but they were not very successful and jurisdiction over labor affairs remained largely in the hands of the police.

This state of affairs led many labor leaders to conclude that improvement of the condition of labor required political action. Some thought in terms of democratic reforms which would make it possible to mobilize the voting strength of the masses by constitutional means. Others, who believed that a regime founded on force could be moved only by force, advocated direct action for revolutionary goals. Still others felt that labor could gain most by accepting the existing regime and cooperating with the authorities. Western social philosophies, such as social democracy, syndicalism, and communism, as well as the official doctrines of nationalism and the "way of the emperor," competed for allegiance among the intellectuals who provided most of the leadership for labor organizations. As a result, constant factional conflict seriously weakened the labor movement.

Development of the Labor Movement to 1945.—Feudal Japan had developed a number of craft guilds of skilled artisans, but these gradually disappeared with the growth of factory industry. As in other countries, the modern labor movement in Japan began with spontaneous demonstrations by small groups of workers in protest against specific grievances, with little thought of permanent organization. Such small-scale protests are recorded as early as the 1870's. Perhaps the first large dispute occurred in 1883, when the ricksha men of Tokyo went on strike in protest against the introduction of streetcars. Their organization was short lived, as were others formed in the next few years in other

trades. In 1897 a Society for the Formation of Trade Unions (Rodo-kumiai Kisei-kai) was organized by several Japanese who had lived in the United States and had studied the operations of the American Federation of Labor. Some progress was made among ironworkers, printers, lithographers, carpenters, dollmakers, and other groups, notably locomotive engineers, who conducted a well-organized and successful strike in 1898, led by the well-known Socialist, Sen Katayama (who later became a Communist). Following the Public Peace Police Law of 1900, however, these unions were stamped out, and no further attempts at open and systematic labor organization occurred until 1912. Nevertheless, several large strikes took place, notably those at the Ashio copper and Bessho silver mines in 1907, which were suppressed by military force.

In 1912, Bunji Suzuki founded the Yuai-kai (Friendly Love Society), whose purpose was to advance the interests of workmen by moderate and lawful methods of education, mutual aid, and cooperation between labor and management. This movement was tolerated by the authorities and made some headway, but was soon caught up in the wave of labor unrest during and immediately after World War I. This was a period of great industrial expansion which provided relatively favorable conditions for trade union growth. Business prospered, but labor often suffered when wages failed to keep pace with the rising cost of living. Many strikes occurred, reaching a peak in 1919, with 497 strikes involving 63,000 workers. One dispute alone, at the Kawasaki dockyards, involved 15,000 employees and was successful in winning an eight hour day. The great rice riots of 1918 also testified to a rising tide of discontent among urban workers. The cautious moderation of the Yuai-kai was challenged by other organizations with a more militant program, and in 1921 the Yuai-kai reorganized on modern trade union lines, taking the name of Nippon Rodo Sodomei (Japanese Federation of Labor).

The 1920's were a relatively liberal period in Japan, during which military influence was subordinated to civilian, and progress was made toward the development of true parliamentary government. Japan cooperated with the League of Nations and the International Labor Organization (ILO) and was on the whole receptive to currents of Western liberal thought. The appointment in 1924 of Bunji Suzuki, a trade union nominee, as the Japanese workers' representative to the ILO amounted to recognition by the government of labor unions as legitimate organizations. They were still viewed with suspicion, however, and militant action or radical views were sternly dealt with. Under the Peace Preservation Law of 1925 thousands of labor leaders, including a few Communists, were arrested. After the invasion of Manchuria in 1931 military control over the government grew steadily stronger and the nation moved toward a war footing, with almost complete regimentation of economic and political life. Repression of labor activities became increasingly severe, culminating in 1940 with the extinction of independent trade unionism.

Many labor disputes occurred in this period, their number fluctuating with changing economic and political conditions. From a low point during the postwar depression the number of disputes rose to a peak of 2,456 in 1931, when they

involved 154,000 workers, according to official figures. Of these, 998 disputes, involving 64,000 workers, were accompanied by a strike or other interruption of production. Following the Manchurian crisis the number of disputes declined, then rose to 2,126, involving 213,000 workers, in 1937. After the outbreak of the Sino-Japanese War in 1937, labor disputes decreased rapidly; only 330 occurred in 1941. Many of these disputes were small affairs, precipitated by local grievances, sometimes without previous union organization. Large, organized strikes were comparatively rare, although some occurred, notably the great seamen's strike of 1928, which won Japan's first minimum wage agreement, and the strike which broke out in 1930 in the Kane-gafuchi cotton mills despite highly paternalistic conditions. In these conflicts with management, labor's objectives were almost entirely economic, wages being the principal issue. Labor lost more strikes than it won, although many disputes were settled by compromise. Collective bargaining, as the term is understood in Western countries, hardly existed except in the strongly organized shipping industry.

Although labor victories were few, trade union membership increased steadily from 103,000 in 1921 to 420,000 in 1936, but this peak figure represented only 6.9 per cent of all nonagricultural workers. Seamen were the most highly organized group (about 90 per cent), followed by municipal transit workers. In factory industry labor organization was weak except in certain sectors of metals, machinery, chemicals, and communications. Japan's leading industry, textiles, where much of the labor force consisted of young girls living in company dormitories, remained almost entirely unorganized.

Owing to conflicting views on ideology and tactics and to changing circumstances, labor organizations in this period appeared and disappeared, split and recombined, with great frequency. The principal Right-wing group was the Japanese Federation of Labor (JFL), which, after a short period of militancy under radical leadership in the early 1920's, pursued cautious and moderate policies, seeking gradual improvement of labor's condition by legal and orderly methods. Like other national federations, the JFL was rather loosely organized, with local affiliates enjoying considerable autonomy and often seceding from the parent body. Nevertheless, the JFL preserved its identity throughout the period as the leading Japanese labor organization. Even stronger in its own field was the Japan Seamen's Union (Nippon Kain-kumiai), a highly conservative group which enjoyed the patronage of both the shipowners and the government. In the 1930's these and other Right-wing groups were loosely linked in the Japanese Trade Union Congress (Nippon Rodo-kumiai Kaigi), which served chiefly as a vehicle for consultation on matters of general policy. On the extreme Right, the 1930's saw the emergence of a fascist labor group, the National Convention of Patriotic Labor Unions (Aikoku Rodo-kumiai Zenkoku Konwa-kai).

During World War I, Japanese Left-wing thought was influenced chiefly by anarchosyndicalism. Later, socialism of various brands gained ascendancy, while after the Russian Revolution communism won converts on the extreme Left. In 1925 a Leftist group seceded from the JFL and formed the Council of Japanese Labor

Unions (Nippon Rodo-kumiai Hyogi-kai), which, after leading a number of strikes, was dissolved by the government in 1928. Its successor, the National Congress of Japanese Labor Unions (Nippon Rodo-kumiai Zenkoku Kyogi-kai), reputedly under Communist influence, continued to carry on some underground activity. Another group, which held radical views, but sought to operate within the law—the so-called legal Left—was organized in 1930, and in 1934 took the name of National Council of Japanese Labor Unions (Nippon Rodo-kumiai Zenkoku Hyogi-kai). This body was dissolved by the government in December 1937, and its leaders were arrested.

In addition, there were a number of small centrist organizations, notably the National League of Labor Unions (Zenkoku Rodo-kumiai Domei), formed in 1930 by several groups which had split off from the JFL. Inclining more to the Right than to the Left, the center groups made several unsuccessful attempts to bring about some measure of unity in the labor movement.

Prior to 1925 it was hardly possible for ordinary citizens to exert any political influence except by humble appeals to the authorities or by direct action. The introduction of universal manhood suffrage in 1925 provided an impetus for the formation of farmer-labor parties, usually sponsored by existing labor and peasant unions; leadership of parties and unions was largely interchangeable. The Left-wing parties suffered from the same schismatic tendencies as the labor unions, as well as from the attentions of the police. Nevertheless, the proletarian parties made considerable progress in the decade preceding the Sino-Japanese War, though they did not seriously challenge the electoral supremacy of the two older conservative parties, the Seiyukai and the Minseito.

A Social Democratic Party had been founded as early as 1901 by Isoo Abe, Sen Katayama, and others, but it was immediately suppressed, as was a Socialist League formed in 1920. A Communist Party was organized in 1922, but by 1929 most of its members were in jail.

The first Farmer-Labor Party (Nomin Rodoto) was organized in 1925 by the Japan Farmers' Union (Nippon Nomin-kumiai) and certain centrist trade unions, but it was immediately dissolved by the government. By 1928, however, when the first election with full suffrage was held, there were four proletarian parties, which polled 489,000 votes and elected 8 members to the lower house of the Diet (total membership, 466). The strongest of these, the Labor-Farmer Party (Rodo Nominto), was dissolved by the government after the election for alleged radical tendencies. In the ensuing decade the principal proletarian group was the Social Democratic Party (Shakai Minshuto), organized in 1926 by Bunji Suzuki, Isoo Abe, and others of moderate Socialist views; in 1932 it merged with other organizations to form the Social Mass Party (Shakai Taishuto). Both of these parties were closely linked to the JFL and the Japan Farmers' Union. In general they advocated mild reforms designed to introduce greater democracy in government and to improve the condition of peasants and industrial workers, such as reducing the powers of the House of Peers, the reduction of farm rents, and unemployment insurance. There were in addition various smaller parties linked with Left-wing farmer and labor organizations and

having somewhat more radical programs. In the election of April 1937, a few months before the outbreak of war with China, the proletarian parties polled nearly 1,000,000 votes (10 per cent of the total) and elected 37 candidates, doubling their Diet membership.

This increase in the Left-wing vote indicated a significant degree of popular dissatisfaction with the growing militarization of the Japanese government, which laid heavy burdens on the masses and restricted their freedom of action. Labor and farmer unions and parties, weak as they were, represented a divisive force in a Japan which, especially after passage of the National Mobilization Law of 1938, was moving ever closer to total regimentation for total war. Japan's leaders therefore sought to win over some of the mass organizations and suppress the rest. Appeals to patriotic sentiment were effectively used to combat unrest among the masses. After the Manchurian incident of 1931, and even more after the beginning of war with China in 1937, many Right-wing labor leaders espoused the doctrines of ultranationalism, whether from conviction or from expediency. Leaders who had earlier opposed imperialistic adventures, at least in principle, were now forced to change their views, keep silent, or go to jail.

Employers, in contrast to labor, were strongly organized in numerous trade associations, chambers of commerce, and local groups, which were concerned among other things with securing legislation favorable to employers' interests and with measures to combat the growth of trade unionism. Outstanding among the groups primarily concerned with labor relations were the Japan Industrial Club (Nippon Kogyo Kurabu) of Tokyo and the Osaka Industrial Society (Osaka Kogyo-kai). The first national employers' association was the National Federation of Industrial Organizations (Zenkoku Sangyo Dantai Rengokai), a powerful body formed in 1931 to oppose a pending trade union law. Employers sought to counteract labor unrest by fostering the spirit of paternalism in industry, and to head off the growth of independent trade unionism by organizing welfare associations or company unions among their own employees. In 1936 the company unions counted 1,347,000 members, or three times as many as the independent unions.

Somewhat similar in purpose was the Harmonization Society, organized in 1919 to promote harmony between capital and labor, and backed by the government and by representatives of big business. Early in the Sino-Japanese War, in 1938, this society launched the Industrial Patriotic League (Sangyo Hokoku Renmei) with the object of promoting cooperation between labor and capital to advance Japan's national aims. In 1940 this movement was taken over by the government, which formed the Industrial Patriotic Association (Sangyo Hokoku-kai, commonly abbreviated as Sampo). The Left-wing unions had been dissolved in 1937, and the remaining unions, voluntarily or otherwise, were absorbed into Sampo. In 1940 also, the Social Mass Party, along with all other political parties, voluntarily disbanded and merged into the Imperial Rule Assistance Association, Japan's state-sponsored totalitarian party, which worked closely with Sampo.

The purpose and functions of Sampo were roughly similar to those of the Nazi Labor Front in Germany. Branches were organized in every

industrial establishment having 50 or more workers. All employees were expected to join, and the owner or factory manager was usually the head of the association. By 1943, Sampo had 86,000 branches and approximately 6,000,000 members. It carried on intensive patriotic propaganda, organized various projects to aid the war effort and to promote industrial efficiency, and conducted certain welfare activities. As World War II progressed, more forceful measures were found necessary. Labor conscription was introduced in 1942, and in 1944 military discipline was applied to workers in war plants and mines. Meanwhile, the conditions of labor steadily deteriorated as a result of inflation, shortages of food and other commodities, longer working hours, and the bombing of Japanese cities. While labor unrest was kept well under control, several hundred small strikes were recorded during the war years.

Labor After World War II.—The years immediately following World War II provided, for the first time in Japanese history, a favorable climate for the growth of labor organization. Released from former restraints and aided by Allied occupation policies, the labor movement quickly revived and, for a time, made rapid progress. As before the war, its objectives were political as well as economic, and it was in constant factional turmoil. As time went on, the opposition stiffened, and various legal limitations were imposed on labor action.

In line with their policy of encouraging democratic tendencies in Japan, the Allied occupation authorities proclaimed, within broad limits, freedom of speech, press, and organization. Sampo was dissolved, old laws restricting labor activity were abrogated, the powers of the police were curbed, and political prisoners were released. On Oct. 11, 1945, Gen. Douglas MacArthur, supreme commander for the Allied powers (SCAP), publicly called on the Japanese government to encourage the unionization of labor. This policy was based on the belief that industrial labor could, with proper guidance, become a powerful force for democracy and a bulwark against political reaction. The occupation authorities sought to introduce into Japan a system of labor relations based, so far as possible, on the best United States practice. A new Trade Union law (1945) guaranteed the right of organization and collective bargaining, and a Labor Relations Adjustment Law (1946) set up machinery for peaceful settlement of labor disputes through conciliation, mediation, or arbitration by impartial committees (both laws were revised in 1949 to impose certain restrictions on unions). A Labor Standards Law (1947) and related legislation sought to fix minimum legal standards for wages and conditions of employment. A Labor Ministry was established in 1947.

Having set up this machinery, SCAP intended to let the Japanese operate it with a minimum of interference, but the inexperience of Japanese labor, employers, and government officials made it necessary for SCAP to give strong, though usually informal, guidance to all parties in important labor disputes. On several occasions, SCAP intervened openly to prohibit strikes which, it was feared, would disrupt the national economy. This reflected not only the gradual shift of emphasis in occupation policy from political reform to economic recovery, but also its opposition to communism, for Communists had been

active in organizing strikes. Similar motives lay behind SCAP's recommendations of July 1948, which resulted in revision of the civil service law to cancel or limit the rights of collective bargaining previously enjoyed by government employees.

The postwar labor movement was conditioned not only by occupation policies, but also by the economic and political situation in Japan. In the first postwar years production was stagnant; food, clothing, and other necessities were in extremely short supply; and prices mounted rapidly on a wave of inflation. To urban labor, which had suffered severe privations during the war, peace brought no improvement. Unemployment was widespread, although the paternalistic tradition against discharging workers counteracted in part the effects of business depression. Under such circumstances labor unrest was inevitable, and occupation policies gave it the opportunity of expression.

Labor's demands were addressed to the government as well as to employers. Many of the workers' early grievances—for example, an inefficient rationing system and inequitable income taxes—could be corrected only by government action. About one fourth of the nonagricultural labor force was employed directly by the government, which owned most of the railways, the communications systems, and several state monopolies. Other major industries were regulated or subsidized by the government, which could in effect determine their wage policies. In any case, it was obvious that no substantial improvement in labor's condition could be expected except through an overall program of national economic reconstruction, which the government was slow to undertake. Beyond this, democratization was the watchword of the day, and most labor leaders were dissatisfied with the rate of progress. The conservative parties, which largely dominated successive Cabinets, were reincarnations of prewar parties which had represented big business interests and were unsympathetic, if not hostile, to the claims of labor. Although many wage earners voted for conservative candidates, most leaders of organized labor rejected them, dividing their support among the parties of the Left or taking an independent Left-wing stand.

The young postwar unions suffered from a lack of experienced leaders, which often led to ill-considered or irresponsible tactics. The millions of workers who swarmed into the unions, some with enthusiasm and some from the habit of conformity, had little knowledge of trade union methods or of elementary democratic procedures. Accustomed to submitting to superior authority, they tended to follow their leaders blindly, and the leaders in turn tended to expect unquestioning loyalty and obedience from their followers. On the other hand, competition within the leader group led to heated and sometimes violent debates, which made it difficult for any small group at the top to impose its views. Nevertheless, dictatorial control by political fanatics or ambitious careerists was a constant danger. Another danger was that of falling under the control of employers. "Puppet" or company unions, well known in prewar Japan, were a favorite tactic of employers in combating independent trade unionism.

Organization was strongest in the large-scale industries, leaving Japan's many small-scale industries almost untouched. Most unions were

organized on a plant or company basis, embracing both white-collar and manual workers. Such units tended to be oriented toward their own individual enterprises, which often had a divisive effect upon the labor movement as a whole. Nevertheless, many of the local units soon combined to form national industrial unions and then federations. Two national federations were organized in 1946: on the Right the Japanese Federation of Labor (known as Sodomei; later called the General Federation of Japanese Trade Unions), a revival of the prewar organization of the same name; and on the Left the new National Congress of Industrial Unions (known as Sanbetsu). There were also a smaller centrist federation, numerous independent national unions, many smaller groupings set up on a local, company-wide, or other basis, and many unaffiliated local unions.

Social Democrats (Socialists) and Communists, competing keenly for labor support, took an active part in organizing the new unions. The Social Democrats, who sought to gain political power by constitutional means, tended to counsel moderate and legal tactics, while the Communists advocated more aggressive and militant methods, including use of the strike as a political weapon. Sodomei was controlled largely by the Social Democrats. When, in 1950, the party split into Left and Right wings, the Right wing retained control of the labor federation, but several unions later seceded. Sanbetsu was originally somewhat larger than Sodomei and much more loosely organized. The Communists made strenuous and partially successful efforts to bring it under their control; they played a dominant role in determining the policies of the national headquarters, but often failed to impose centralized control on the various affiliated unions.

In many labor disputes it was difficult to disentangle economic from political motives. The peak of direct action by labor came in January 1947, when a threatened strike of government employees in support of legitimate wage demands mushroomed until it approached the proportions of a general strike to force the resignation of Shigeru Yoshida's first Cabinet. This mass movement, which was partly but not wholly of Communist inspiration, reflected a protest against economic hardship and also a confused desire for political change, vaguely defined as "a Cabinet based on the Social Democratic Party." At the 11th hour the proposed strike was banned by order of SCAP. Later, the wage demands of the government employees were met in part, and a new election was held, which resulted in the formation of a coalition Cabinet headed by a Social Democrat. After this episode labor did not lose interest in politics, but shifted its efforts toward normal political channels. Many unions took an active part in election campaigns, generally supporting Social Democratic candidates. On various occasions, however, brief but widespread strikes were called in protest against legislation regarded as prejudicial to labor.

After the abortive strike in January 1947 factional struggles became more intense within Sanbetsu and many independent unions. These frequently took the form of a three-way conflict among Communist sympathizers, conservatives, and a third group which was militant but anti-Communist. In 1947-1948, with SCAP encouragement, democratization leagues were organized within many unions to combat Communist

influence, and by 1949 Sanbetsu had lost more than half of its membership. The decline of Communist influence was due partly to a revulsion against Communist tactics, partly to anti-Communist measures taken by SCAP and the Japanese government, and partly to the discharge by government and private employers, in 1949, of many known or suspected Communists. The outbreak of war in Korea in June 1950 led to intensified action by SCAP and the government to curb Communist activity. By the end of 1950, Sanbetsu had practically disappeared, and the newly formed General Council of Japanese Trade Unions (Sohyo), under anti-Communist (chiefly Left Socialist) leadership, had assumed the leading position in the labor movement. The Communists, now forced to operate largely underground, made vigorous efforts to recoup their losses, and by 1953 were said to have gained considerable influence in Sohyo. As a result several unions seceded from Sohyo and, in 1954, combined with Sodomei to form a new anti-Communist federation, Zenro.

Union membership reached its peak in March 1949, with 6,896,000 organized workers, of whom about one fourth were women. The total dropped in the next two years, then turned upward; in June 1953, it was 5,851,000, representing about 40 per cent of all nonagricultural labor. In 1953 Sohyo had 3,273,000 members (56 per cent of all organized labor), Sodomei 240,000, Sanbetsu 13,000, and Shinsanbetsu (an anti-Communist splinter group) 39,000. Zenro, formed in 1954, claimed 800,000 members including several former Sohyo unions. Among the major unions affiliated with Sohyo in 1954, with approximate membership, were the teachers (535,000), government railway workers (370,000), coal miners (270,000), local government employees (200,000), postal employees (160,000), iron and steel workers (125,000), private railway workers (120,000), telephone and telegraph workers (105,000), and United States garrison force employees (100,000). Zenro included, besides Sodomei, the textile workers (360,000) and seamen (100,000). There were also in 1953 about 30 independent national unions with 796,000 members; 856,000 in unions affiliated with local or minor groups; and 695,000 in unaffiliated locals.¹ Government and government enterprise employees were strongly organized with their own liaison council.

In the economic field, labor's principal demands were for higher wages and security of employment. Demands for wage increases were insistent, especially in 1946-1949, when prices were rising rapidly. Mass discharge of workers by government or private employers, in the interests of economy and rationalization, met with strong protests from organized labor. A demand often heard in the early postwar years was for democratization of management, an ill-defined term which sometimes meant union participation in determining company policies. In the first year or two after the war labor's claims met with little opposition. Later, the opposing forces recovered their self-confidence; employers offered stiff resistance to union demands, and the police took a stronger hand in labor affairs.

Although thousands and, at some periods, millions of workers were involved in labor disputes, the amount of time lost through strikes was not large; many disputes were settled peacefully,

and most strikes were short. Figures on work stoppages in 1946-1953 are as follows:

	Number of stoppages	Number of workers involved	Man-days lost	
			Number	Per cent of total worked
1946	702	517,415	6,266,255	.253
1947	464	218,832	6,035,783	.142
1948	744	2,304,492	6,995,332	.197
1949	554	1,122,123	4,320,688	.172
1950	584	763,453	5,486,059	.158
1951	576	1,162,585	6,014,512	.132
1952	590	1,623,610	15,075,269	.432
1953	585	1,173,958	4,222,026	.116

Nevertheless, strikes in key industries sometimes had adverse effects on the entire economy, which led to stronger regulatory legislation. Since SCAP discouraged large strikes as harmful to economic recovery, and strikes by government employees were eventually banned, many alternative methods of protest were devised, such as demonstrations, slowdowns, absenteeism, and brief walkouts. The machinery of peaceful settlement by impartial committees, backed at first by strong SCAP support and guidance, played a major role in the settlement of many disputes. Some progress was made in developing written contracts and other instruments of collective bargaining on Western models. Occasional violence appeared on the part of labor, and employers, but serious incidents were rare.

After Japan resumed full sovereignty on April 28, 1952, the government took a stronger line toward labor. Various regulatory laws were passed, and it was hard to draw a line between suppression of subversive activity, necessary regulation of labor affairs, and repression of legitimate union action. Employers also became more active in combating labor tendencies of which they disapproved. The labor unions were financially weak and were rent by factional and ideological strife, and Communist influence was by no means dead. By 1954 it could be said that, by comparison with prewar years, organized labor had achieved a position of considerable strength and standing in Japan, where it represented a substantial political minority group. Yet because of its own organizational weaknesses, together with the persistence of prewar social and economic patterns, the future of the labor movement was far from clear.

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9. TRANSPORTATION AND COMMUNICATIONS. The development of transportation and communications systems in Japan has been conditioned by two basic factors. First, the fact that Japan is an insular country with a mountainous terrain and with most of its leading cities situated along the coasts has made coastal shipping important, has shaped the pattern of the railroads, and has retarded the development of highways. Second, the Japanese government has played a significant role in developing, supervising,

¹ These figures include some overlapping.

ing, and controlling virtually all means of transportation and communications. All forms of communications have always been operated either directly by the Japanese government or through government-controlled corporations; all forms of transportation have been regulated by the government, which has also operated directly most of the railroads and, since 1941, most domestic shipping. These two factors can be traced in the following sections, which discuss the development of Japanese railroads, domestic shipping, highways, air transportation, telephone and telegraph services, international communications, radio and television, and postal services.

TRANSPORTATION

Railroads.—Shortly after the Meiji Restoration of 1868, the government began to draw up plans for the building of a railroad to connect Tokyo with other Japanese cities. In 1869 plans were completed for a railroad linking Shimbashi in Tokyo with Yokohama, Kyoto, Kobe, and Tsuruga (Fukui Prefecture). Authorization was granted to construct the first part of the line between Tokyo and Yokohama, a distance of 18 miles; the cost of this project was estimated at about 500,000 yen. The Japanese government, however, was unable to raise this amount from domestic sources, and it therefore accepted the offer of H. N. Lay, an Englishman, to finance the project. A Japanese government loan of £913,000 was then floated in London. This financing not only represented Japan's first foreign loan, but also resulted in the initial use of British engineers and British railroad equipment in building Japanese railroads.

The line between Tokyo and Yokohama was completed in September 1872; it was followed in 1874 by a line between Kobe and Osaka (a distance of 20 miles), which was extended three years later to Kyoto. By 1889, two decades after the first plans for railroad construction had been made, the Japanese government had completed the Tokaido line between Tokyo and Kobe (a distance of 380 miles), and had virtually completed a branch line connecting Tsuruga with the Tokaido line in order to connect the Japan Sea with the Pacific Ocean by rail. In addition to these lines, 55 miles of railroad had been completed in Hokkaido to aid in the colonization of that island. Some private railroads were also built during this period with the aid of government subsidies.

Railroad development in Japan, however, did not advance as rapidly as the government thought necessary in the light of the development of other sectors of the country's economy, as well as of the strategic importance of an adequate railroad network. As a result, in 1892 the Diet passed the Railway Construction Law, which established a comprehensive railroad building program for 149 lines with a total length of 6,350 miles. The law also recommended that the government consolidate all rail lines into a unified state-owned system by purchasing private lines. The government embarked on its construction program, but it was not until 1907, after it had experienced difficulty in controlling the private lines during the Russo-Japanese War, that nationalization of the railroads took place. Of the 36 private lines with a total mileage of 3,248 miles then in existence, the government purchased the 17 most important lines, with a total mileage of 2,823 miles, leaving only minor local lines in private hands.

The government's railroad building program advanced steadily after 1907, and even private local railroad building increased. By 1953 the total length of main track in Japan amounted to 17,200 miles, of which 12,400 miles were government owned. Over 10 per cent of the electrified trackage in operation in 1953 had been built since 1945. The total mileage of Japanese railroads compared with the approximately 223,000 miles of first main track in the United States in 1953. It should be noted, however, that Japan had more trackage per unit-area than the United States, though less than England, France, or Germany.

Japan's railroad system closely reflects the shape and terrain of the country. Because the interior of the country is mountainous, the main lines generally follow the coasts, while the secondary lines cross the mountain chains to connect the east and west coast main lines. Since the most important Japanese cities are located on or near the coasts, they are directly connected by the main routes.

Only a few lines are of major importance. The oldest and most important is the Tokaido line between Tokyo and Kobe. The Sanyo line, which is a continuation of the Tokaido, connects Kobe with Shimonoseki at the western tip of Honshu. At Shimonoseki an undersea railroad tunnel to Moji connects the Sanyo line with the Kagoshima and Nippo lines, which run, respectively, along the west and east coasts of Kyushu. North of Tokyo the Tohoku and Ou lines connect the capital with Aomori in the northern part of Honshu. A railroad ferry connects the Tohoku and Ou lines with Hokkaido's Hakodate main line. The latter connects Hakodate with Asahigawa, which in turn is connected with Wakkanai at the northern tip of Hokkaido by the Soya line. Other important lines are the Sanin line between Kyoto and Shimonoseki along the northern coast of Honshu; the Chuo line, which connects Tokyo with Nagoya through the interior of Honshu; and the Takasaki, Joetsu, and Shinetsu lines, which connect Tokyo with Naoetsu and Niigata on the Japan Sea coast.

The nature of the Japanese terrain necessitated the construction of many tunnels, curves, bridges, retaining walls, and steep grades. In order to economize in the building of a railroad system that required these features, a narrow gauge of 3 feet 6 inches (1.067 meters) was adopted as the standard, compared with a railroad gauge of 4 feet 8½ inches in most other countries of the world. Because of the use of a narrow gauge, Japanese trains are slower and have a smaller carrying capacity than those of the United States and of most European countries. The rolling stock is small and light weight, and the trains have relatively few cars.

About 28 per cent of the railroad system was electrified by mid-1953; over three fourths of the electrified mileage was privately owned, being similar to suburban electrified passenger lines in the United States. Most of the mileage of Japanese railroads is single track. In mid-1953 the government-owned railroads had 5,066 steam and 402 electric locomotives, 11,625 passenger cars, 106,626 freight cars, and 2,710 electric cars. Employees on government and private railroads totaled 573,000, or 33.3 per mile, compared with 5.7 employees per mile in the United States. The number of employees on Japanese railroads in 1953, however, represented a significant re-

duction from the 753,000, or 40.5 per mile, at the beginning of 1948.

Before World War II the Japanese railroads carried only about 30 per cent of the tonnage of the country's domestic trade. Little of the rail tonnage required long hauls, and most of it moved between local ports and their hinterlands, longer shipments being made by coastwise shipping. Unlike the case with railroad systems in other countries, revenue from passenger traffic and passenger train mileage consistently exceeded revenue from freight and freight train mileage respectively.

During World War II the amount of freight carried on Japanese railroads increased significantly as ships that had been engaged in coastal trade were diverted to other routes, and gasoline, tires, and other automotive essentials were diverted from civilian to military needs. By 1943 the railroads reached their peak operations. In that year freight tonnage totaled 214,400,000 metric tons, and freight train kilometers totaled 42.1 billion. Passenger traffic amounted to 4.6 billion, and passenger train kilometers totaled 93 billion.

The heavy volume of wartime freight, the Allied bombings, and a lack of repair parts resulted in a marked deterioration of the Japanese railroad system by the end of the war, and the economic chaos that prevailed in Japan in the first two years after the surrender in 1945 prevented the early rehabilitation of the railroads. Despite a great decrease in the number of trains that could be operated, there was a significant increase in passenger travel as the Japanese people went into the country in search of food. Although there was a sharp decrease in freight movements, the railroads continued to carry a larger portion of the country's freight than did coastal shipping. It was not until 1950, when the Japanese economy entered a period of increasing activity because of the Korean War, that the Japanese railroad system began to make some progress toward rehabilitation. By 1952 the national railways carried more freight than at any time previously except for the war years, and a new record was set for the number of passengers carried. The proportion of the total freight carried by rail, however, remained about the same as before the war. Freight carried in 1952 by both national and private railroads aggregated 172,600,000 metric tons. In the same year these railroads carried 5.7 billion passengers, and the street railways carried 2.9 billion. The big problem facing Japanese railroads was the transportation of commuters, especially in the Tokyo area. Although by 1952 the national railways had doubled their electric railway capacity over prewar (1936) levels, passenger traffic had increased more than threefold.

Until 1908 government railroads had been administered first by the Home Ministry and later by the Communications Ministry. In December of that year they were placed under the newly created Railway Board, which was directly responsible to the Japanese Cabinet. In May 1920, the board was converted into the Ministry of Railways as an independent department of the government. This organization operated until 1943, when wartime conditions led to the creation of the Ministry of Transportation and Communications, which united the administration of railroads, highways, waterways, aviation, telephone, telegraph, radio, and postal services under a

single control. In 1945 the ministry was dissolved into two separate organizations, one for transportation and the other for communications. In December 1948, the Diet passed a law establishing the Japanese National Railways as a government corporation empowered to carry on all activities involved in the operation of the government-owned railroads. The Ministry of Transportation was given responsibility for supervision of the corporation, but the latter was made largely autonomous in its operations. The minister of transportation has the power to approve or disapprove new railroad construction, the taking over of other transportation enterprises, the supervision or cessation of any working line, and the inauguration of ferry service or motor transportation related to the railroads. He also supervises private rail lines.

Domestic Shipping.—Until its entrance into World War II, Japan probably moved a larger share of its domestic traffic by water than did any other country. In the prewar period the value of Japan's domestic waterborne commerce was twice that of its foreign commerce; only four ports in 1936 handled foreign trade with value exceeding that of their domestic trade.

The prewar importance of coastal shipping was due to a number of factors. Japan has a long coastline and numerous good harbors. The quiet waters of the Inland Sea make it possible for very small vessels to ply between the ports of Kobe and Osaka at its eastern end and Moji and Shimonoseki at its western end. Most of Japan's population and industrial centers are located on or near the coasts. The rugged terrain of the country has made railroad and highway development difficult and expensive. Lastly, before World War II water freight rates were as little as one third of the rail freight rates.

With World War I as an impetus, the Japanese merchant marine increased steadily until during the 1930's it ranked third in size behind the British and United States merchant marines. In 1940, Japan had a total of about 6,900,000 gross tons of all types of shipping, of which about 6,000,000 tons consisted of steel ships of 100 gross tons and over; 15 to 20 per cent of the total tonnage was engaged in coastal shipping.

The effect of World War II on Japanese coastal shipping was to shift many of these vessels to ocean shipping and thereby to place a greater emphasis on rail transportation for domestic freight movements. As a result of Allied sea and air operations, the Japanese merchant marine lost 8,900,000 gross tons of shipping. By the end of the war, therefore, despite wartime construction there were only about 4,000,000 gross tons of all types of shipping afloat, of which only 1,400,000 gross tons represented steel ships of over 100 gross tons in size. Moreover, a large part of this tonnage was unseaworthy.

By 1953 coastal shipping had not been able to regain its prewar position in freight movements, although the Korean War had resulted in substantially increased coastwise traffic, and the Japanese merchant marine had increased the tonnage of its steel ships of over 100 gross tons in size to a total of 2,900,000 gross tons. In October 1945, only about 750,000 metric tons were moved in coastal trade in all types of vessels; in 1950 these shipments averaged 3,725,000 tons monthly; in May 1951, a postwar peak of 6,160,000 tons was reached. Whereas in 1936 coastal vessels had moved 18 per cent of Japan's total freight,

in 1952 coastal vessels moved only 9 per cent of the total. Important factors in the poor postwar position of coastal shipping were artificially low railroad and truck rates and significant increases in the costs of building and maintaining ships.

Until 1937, Japanese shipping was in private hands and free from government control, although it had been subsidized by the government for many years. In that year, however, the Japanese government passed legislation which gave the Ministry of Communications (and later its war-time successor, the Ministry of Transportation and Communications) authority over civilian merchant shipping, including ship transfers, prices, construction, routes, and rates. Although the ministry relied at first on voluntary controls, by the outbreak of the Pacific war Japanese shipping was subject to full control by the ministry. In March 1942, the Japanese government seized all civilian-operated merchant shipping and paid the owners charter fees. The ships were then turned over to a newly created Shipping Control Association for operation. The control exercised by the association was terminated at the end of the war. The United States Naval Shipping Control Authority for Japan ((SCAJAP) was then established by the occupation authorities to supervise the control and operation of all Japanese merchant steel vessels of 100 gross tons and over. These controls were terminated with the end of the occupation in 1952, and the Ministry of Transportation exercised supervision over the merchant marine thereafter.

Highways.—Besides being the oldest means of transportation in Japan, highway transportation is the starting point of much other transportation. The existence of a large number of industrial facilities off the railroad lines makes it necessary for vehicles, under motor, animal, or human power, to haul freight to rail lines and to dockside.

The first systematic development of roads in Japan occurred during the Tokugawa era (1603-1867), when the shoguns laid out five trunk highways. These were (1) the Tōkaidō, connecting Tokyo with Kyoto along the coast, a distance of 310 miles; (2) the Nakasendō, connecting Tokyo with Kyoto through the interior, a distance of 324 miles; (3) the Nikkōkaidō, connecting Tokyo with Nikko (Tochigi Prefecture), a distance of 89 miles; (4) the Ushūkaidō, connecting Tokyo with Aomori, a distance of 465 miles; and (5) the Kōshūkaidō, connecting Tokyo with Shimosuwa (Nagano Prefecture), a distance of 132 miles. After the Meiji Restoration, these highways became the basis for Japan's modern transportation system, with railroads as well as highways following the routes of the old trunk roads.

Because of the rugged nature of the terrain, the concentration of the population along the coast, and the intensive development of railroads, highway development was neglected. This situation continued even after the introduction of motor vehicles, although the earthquake of 1923 caused the rebuilding of many highways and the building of additional roads to accommodate increased traffic. The industrial development and military preparations of the latter 1930's saw further development of Japanese highways. Yet in 1939 the length of national roads amounted to 5,350 miles, or only a slight increase over the mileage that had existed several decades before.

Although highway development did not keep pace with Japan's industrial development, motor trucks carried the major portion of the freight that was moved before World War II. In 1936 motor trucks transported almost 20,000,000 metric tons a month, or 55 per cent of the total freight moved in Japan.

The highway system suffered during the war from failure to keep up maintenance and from Allied military operations. Shortages of road-building materials continued into the postwar period, and, except for highways of strategic importance to the Allied occupation, little was done in the early postwar years to repair Japanese roads. The possibility that deteriorating roads might present an obstacle to Japan's economic recovery led the supreme commander for the Allied powers (SCAP), on Nov. 27, 1948, to issue a directive to the Japanese government to develop a comprehensive five-year public works program for the repair, maintenance, and extension of roads throughout the country. The United States continued to supply Japan with surplus army road-building machinery and with certain materials, especially asphalt. The Ministry of Construction, established on July 10, 1948, replaced the Ministry of Home Affairs (abolished Dec. 31, 1947) as the ministry responsible for Japanese road construction and maintenance.

There are four classes of roads in Japan—national (*kokudō*), prefectural (*fukendō*), municipal (*shidō*), and town and village (*chōsondō*). National roads were built originally to connect Tokyo with the headquarters of army divisions and naval bases, with the Ise Shrine, and with prefectural capitals. The minimum width of these roads is 24 feet. The full cost of military national roads and one half of the cost of other national roads were borne by the national government. Prefectural roads connect the prefectural capital with important places within the prefecture. Their minimum width is 18 feet, and one third of their cost is paid by the national government. Important city roads have a minimum width of 18 feet, and all other roads must be at least 12 feet wide.

In 1950 there were 515,000 miles of all types of roads, of which 6,000 miles were national roads, 72,000 miles were prefectural roads, 54,000 miles were city roads and streets, and the remaining 383,000 miles were town and village roads. Of the total mileage, only about 1.5 per cent represented paved roads; by types, 19 per cent of the national roads, 4 per cent of the prefectural roads, 7 per cent of the city roads, and 0.1 per cent of the town and village roads were paved.

It took five years after the end of World War II for highway transportation to recover fully from the effects of the war. The increased economic activity resulting from the Korean War was primarily responsible for an increase in the motor transport of freight to a level exceeding the prewar peak. A monthly average of over 29,000,000 tons of freight was moved in 1952, and in March 1953 a record of over 32,000,000 tons was reached. Trucks increased their share of freight moved to about 60 per cent of the total in 1952. Bus travel also increased, to a monthly average of 169,000,000 passengers in 1952.

The late and limited development of a motor vehicle industry in Japan was both a contributing factor and an effect of the retarded status of the highways. Until the mid-1930's, Japan was dependent on imported vehicles for most of its cars

and trucks; in 1938, Japanese motor vehicle production exceeded imports for the first time. Production generally increased until a peak output of about 48,000 motor vehicles of all types was reached in 1941. In March of that year there were 204,000 motor vehicles registered in Japan, including 120,000 trucks of various sizes. Production declined during the war and immediate postwar years, but began to rise again in 1947. By 1952 output had increased to an all-time peak of 177,000 vehicles. In February 1953, there were 732,000 vehicles registered in Japan (as compared with 53,294,493 registered in the United States in 1952), of which 415,000 were trucks; 273,000, passenger cars; 25,000, buses; and 19,000, special vehicles such as fire and police trucks and ambulances.

Air Transportation.—In 1910 the first airplane flight in Japan was made. World War I gave an impetus to the development of aviation in Japan, as it did in many other countries. Japanese military airplanes took part in combat for the first time in 1914, in the Tsingtao campaign against German forces. The first regular civil air service was inaugurated in 1922, when hydroplanes began to fly between Sakai, near Osaka, and the island of Shikoku. In January 1923, the newspaper *Osaka Asahi Shimbun* started regular service between Tokyo and Osaka. In July of the same year the Japan Aerial Navigation Company opened regular service between Osaka and Beppu. Airmail service was inaugurated in April 1925 between Tokyo and Osaka. With the formation of the Japan Air Transportation Company (Nippon Koku Yuso Kabushiki-kaisha) in 1929, Japanese civil air transportation began to develop on an extensive route basis. Regular flights were made between Tokyo, Osaka, and Fukuoka, and were later extended to Korea, Manchuria, Formosa, and the mandated islands. By 1938 the lines of this company extended over a distance of 9,575 miles, and it controlled virtually all of the commercial air routes in Japan.

As the Japanese government extended its control over all means of transportation and communications, the Japanese Ministry of Communications fostered the merger in 1938 and 1939 of all airlines into a new company, the Japan Airways Company (Dai Nippon Koku Kabushiki-kaisha). This company was a semi-governmental concern, with a monopoly over all Japanese civil air transportation. It was subsidized by the Japanese government, which also contributed one half of the company's capitalization of 100 million yen. At the end of 1939 the company was operating almost 12,000 miles of air routes. In the same year, Japan had about 120 civil aircraft, of which 85 were scheduled air carriers. About 4,800 airplanes were produced in Japan in that year, but almost all were allocated for military use. In 1939 the Japan Airways Company carried 69,268 passengers, 298 metric tons of freight, and 819 metric tons of mail.

After 1939 considerable expansion took place in the air routes of the Japan Airways Company. With the outbreak of the Pacific war two years later, civil aviation was placed under military control and the civil air routes were used to support military operations. At the end of the war all flying by Japanese was prohibited by the Allied occupation authorities. In November 1945, the Japan Airways Company was dissolved and all aeronautic research institutes and aviation

schools were ordered closed by a SCAP directive.

In 1950, SCAP permitted Japanese corporations to inaugurate air transport service, the actual operation of aircraft to be undertaken by foreign airlines. The first Japanese airline company to be established was the Japan Air Lines Company (Nippon Koku Kabushiki-kaisha), organized in August 1951. In October of that year, Japan Air Lines inaugurated in cooperation with Northwest Airlines the first postwar regular civilian air route, connecting Tokyo, Osaka, Sapporo, and Fukuoka. With the end of the occupation restrictions on Japanese aviation were removed, and in October 1952, Japan Air Lines undertook independent domestic operations. By the end of 1953 at least 11 other airlines were organized to conduct domestic service. In October 1953, a semigovernmental airline was created for international operations. The new company, also called Japan Air Lines, was established through an investment of 2 billion yen, one half by the original Japan Air Lines and the remainder by the Japanese government. It began overseas service to the United States in February 1954. In addition, 11 foreign airlines were engaged in air transportation with Japan at the end of 1953.

COMMUNICATIONS

Telephone and Telegraph.—Telephone service in Japan was first opened for public use in and between Tokyo and Yokohama, in December 1890. Long-distance service was not inaugurated until 1897, when Tokyo and Osaka were connected. The telephone service has usually been regarded as the least efficient communication system in Japan. Although Japanese telephone equipment is considered to be good, ever since telephone service was inaugurated there have been inadequate facilities to meet public demand. In 1940 there were about 1,000,000 telephone subscribers with about 1,500,000 telephones.

During World War II the telephone system suffered heavy damage from aerial bombing. About one fourth of the wire system and half of the telephone instruments were destroyed. Since then much rehabilitation has taken place. From a low of about 800,000 in 1945, the number of telephones increased to 2,400,000 by March 1953. In 1953 there were about 28 telephones in service for every 1,000 Japanese, compared with 310 telephones for every 1,000 persons in the United States. The number of telephone calls grew steadily in the postwar period, reaching over 200,000,000 monthly at the beginning of 1953, compared with a monthly average of 35,000,000 in 1941. Telephone routes cover about 50,000 miles and reach over 6,000 telephone exchanges.

Telegraph service, which was started between Tokyo and Yokohama in 1869, has become the most important means of telecommunications in Japan. In 1939 the number of telegrams sent in Japan exceeded the figure for any other country except the United States. In that year land telegraph lines covered 31,000 miles and connected over 13,000 telegraph offices. Since the end of the war there has been much rehabilitation of the war-damaged telegraph system. The previous peak of 7,000,000 telegrams per month reached in 1943 was surpassed in 1951, and in December 1952 an all-time peak of 9,200,000 telegrams was reached.

Telephone and telegraph services in Japan have always been a government monopoly under the direct control of the Ministry of Communi-

cations and of its wartime successor, the Ministry of Transportation and Communications. Telephone and telegraph services were placed under the Ministry of Electrical Communications in 1949, when the Ministry of Communications was split into two separate organizations for electrical communications and for postal services. On Aug. 1, 1952, the Ministry of Electrical Communications was abolished, and most of its functions were transferred to the Ministry of Postal Affairs. At the same time, there was created under the latter the Japan Telegraph and Telephone Public Corporation to operate Japan's telephone and telegraph facilities. For administrative purposes, the country is divided into 10 telephone and telegraph zones with regional bureaus in the following cities: Tokyo, Osaka, Nagoya, Nagano, Kanazawa, Hiroshima, Matsuyama, Kumamoto, Sendai, and Sapporo.

International Communications.—Japan's international communications facilities include radiotelegraph (wireless telegraph), radiotelephone (wireless telephone), and submarine cable.

Although Japan had radiotelegraph facilities in operation as early as 1908, these facilities were used until 1915 for domestic communications and for contact between Japanese ships and land. In that year the first overseas radiotelegraph message took place between Ochiishi in Hokkaido and Petropavlovsk (now Petropavlovsk-Kamchatski) in Kamchatka. Overseas radiotelegraph communications increased over the succeeding years, and direct circuits were established with the leading cities of the world. In 1925 the Japanese government established the Japan Wireless Telegraph Company (Nippon Musen Tsushin Kabushiki-kaisha), to which the government turned over its radiotelegraph facilities. In 1938 the government merged all international communications in a new company, the International Telecommunications Company (Kokusai Denki Tsushin Kabushiki-kaisha). Half of the stock of the company was owned by the government, and the election of its officers and directors, as well as the company's actions, was subject to the approval of the Ministry of Communications.

The first radiotelephone experiments in Japan were made in 1911, but it was not until 1923 that the service was opened to the public. At first radiotelephone communication was limited to service between ships in Japanese harbors and land. In 1932 the government decided to extend the service, and the International Telephone Company (Kokusai Denwa Kabushiki-kaisha) was formed. Soon radiotelephone service was extended to ships at sea, to Japanese colonies, and, between 1934 and 1937, to most parts of the world. In 1938 the International Telephone Company was also taken over by the International Telecommunications Company.

The International Telecommunications Company continued to operate for almost two years after V-J Day. On March 25, 1947, however, SCAP issued a directive to the Japanese government, ordering it to liquidate the company, and to take over the operation of international telecommunications directly. An International Telecommunications Division in the Ministry of Electrical Communications, created in 1949 as a result of the division of the Ministry of Communications, became the successor to the liquidated company. This function was transferred to the Ministry of Postal Affairs when the Ministry of Electrical Communications was abolished in 1952.

Local administrative bureaus for international telecommunications are located in the same cities as those for telephone and telegraph services.

Japan's international telecommunications transmitting and receiving facilities are handled by two systems: the Eastern Japan Radio Central at Tokyo and the Middle Japan Radio Central at Osaka. The principal transmitting station for radiotelephone communications is at Nazaki in Ibaraki Prefecture, and the principal receiving station is at Komuro in Saitama Prefecture. Radiotelegraph communications are handled through transmitting stations at Oyama in Tochigi Prefecture and Yosami in Aichi Prefecture and through receiving stations at Fukuoka in Saitama Prefecture, Yokkaichi in Mie Prefecture, and Ono in Hyogo Prefecture. In March 1953, there were 14,700 radiotelephone calls and 326,300 radiotelegraph messages. These figures represented approximately a fivefold increase and more than a threefold increase, respectively, over the 1949 monthly averages.

Before World War II, Japan had an extensive network of submarine cables connecting the various islands of Japan proper as well as connecting Japan with its colonies and with foreign countries. The principal overseas cables connected Nagasaki in Kyushu with Shanghai and Vladivostok (owned by the Great Northern Telegraph Company, Ltd., a Danish company), and Kamakura (near Yokohama) with Guam (owned by the Commercial Pacific Cable Company, a United States concern). Cables to Europe went through Vladivostok, while cables to the United States went through Guam.

Since the end of the war only the cables connecting the islands of Japan have been in full operation. In view of the development of radiotelegraph and radiotelephone facilities, it was believed that extensive use of submarine cables would probably not develop in Japan.

Radio and Television.—Japan's first radio program was presented over station JOAK in Tokyo on March 22, 1925. Within a few months stations were built in Osaka and Nagoya to meet a growing public demand for radio broadcasts. Before the end of the year the three stations were merged and the Broadcasting Corporation of Japan (Nippon Hoso Kyokai) was formed with the approval of the Ministry of Communications. The corporation was given a monopoly over all radio broadcasting in Japan. Until 1935 the corporation enjoyed considerable independence in its operations; beginning in that year, however, the approval of the Communications Ministry was required for virtually all actions.

When the war ended, the Allied occupation authorities directed the Japanese government to reorganize the Broadcasting Corporation of Japan and to eliminate the control over the corporation that the Communications Ministry enjoyed. When the Ministry of Communications was split in 1949, a Radio Regulatory Agency was created in the Ministry of Electrical Communications. This agency's major function was "to insure that the radio spectrum is employed expressly for the public interest, convenience or necessity in a fair and efficient manner in compliance with international and regional radio conventions, regulations, and agreements. . . ." Regional radio regulatory offices are located in the same cities as the regional telephone and telegraph bureaus.

Although the administration of broadcasting is centered in Tokyo, the actual operation of

local stations is under the control of so-called central stations in eight major cities: Tokyo, Osaka, Nagoya, Hiroshima, Sendai, Kumamoto, Sapporo, and Matsuyama. Two radio networks link these cities with each other and with the local stations. As of May 30, 1953, the Broadcasting Corporation of Japan operated 39 local broadcasting stations and 38 rebroadcasting stations in addition to the 8 central stations. Revenue for the support of the corporation, which excludes advertising, is derived from a license fee of 50 yen per month for each radio receiving set. Overseas broadcasting, which had been suspended since the end of World War II, was resumed by the corporation in February 1952.

Commercial radio broadcasting was initiated in April 1951 with the issuance by the Radio Regulatory Commission (successor to the Radio Regulatory Agency) of licenses to 16 commercial radio stations. As of July 31, 1953, there were 33 commercial stations in operation, supported by paid advertising. The commercial stations organized the National Association of Broadcasters in Japan (Nippon Minkan Hoso Renmei) in 1951 to enforce an ethical code of broadcasting.

Television began in Japan in February 1953 with a telecast from Tokyo by the Broadcasting Corporation of Japan. Subsequently stations were opened in Osaka and Nagoya, and a five-year program called for the completion of 29 other television stations by the corporation by the end of 1956. A monthly fee of 200 yen is charged per set to support the corporation's television operations. Commercial television also got under way in 1953 with the organization of the Japan Television Network Corporation.

Postal Services.—Japan's postal system began in 1871, when service was inaugurated between Tokyo and Osaka. In that year post offices were opened in five other cities and service began between Tokyo and Nagasaki, delivery between the two cities taking from 7 to 8 days. In the following year post offices were opened in all other important cities and towns. There was a steady development thereafter, and within 10 years there were 5,500 post offices.

Foreign mail service was established in 1872 with the creation of British, United States, and French post offices in Yokohama, Kobe, and Nagasaki. The United States post offices were withdrawn in 1873, and the French and British post offices were withdrawn after Japan signed the International Postal Convention in 1877.

Postal savings and postal money order services were started in 1875, parcel post service in 1892, and airmail service in 1925. Other services include an extremely rapid special delivery, registered mail, postal life insurance, the receiving of taxes for the government, the payment of government pensions, and the sale of government bonds. Many local post offices are also telegraph and telephone offices.

The postal system was originally operated by the Ministry of Communications and its wartime successor, the Ministry of Transportation and Communications. In 1949, when the Ministry of Communications was split up, an independent Ministry of Postal Affairs was created. Ten regional postal bureaus were established in the same cities as the regional telephone and telegraph bureaus. Local post offices were originally divided into five and then into three classes depending upon the size of the city or town in

which they were located. In 1941 this classification was dropped and two groups, ordinary post offices (formerly 1st and 2d class) and special post offices (formerly 3d class), were created. In July 1953, there were 678 ordinary and 13,514 special post offices. At the same time there were 177.5 million postal savings accounts with total deposits amounting to about 294 billion yen, and postal life insurance policies with a total face value of about 752 billion yen.

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10. FINANCIAL DEVELOPMENT.

The old Japanese merchant houses which developed in the feudal period, mainly in Osaka, carried on a limited, rudimentary type of banking operation. They acted as financial agents for the daimyō, selling their rice in the few commercial centers and transmitting funds to the various localities. In times of crop failure they granted loans to the feudal lords. As in Great Britain, many of the leading modern banks in Japan can trace their origins to old merchant bankers, houses such as Mitsui, Iwasaki, and Konoike. It was these *chōnin* (townsmen, or merchants)—especially of Osaka, where 70 per cent of Japan's wealth was concentrated—who provided the financial support which made possible the overthrow of the Bakufu. And it was their financial support, by means of contributions and loans (*goyōkin*), which enabled the new regime to establish itself. The Japanese economic historian Eijiro Honjo states that in the very earliest days of its existence, in December 1867, the Revenue Office (Kinkoku-suitoshō) of the new government issued an urgent plea to Mitsui-gumi for financial aid.

The confused and disorderly state of the currency at the time of the Meiji Restoration of 1868, brought about largely by the varying coinage and paper money emissions of the daimyō and the continued debasing of the coinage by the shogunate government, was increased by the paper money issues of the new government. These issues were necessary because during the early years the new government was unable to balance its budget. The cost of suppressing the hostile clans resulted in 25 million yen of expenditure in 1868, while government revenues plus loans from the merchant bankers or exchange houses amounted to only 9 million yen, leaving a deficit of 16 million yen to be covered by paper money issues. In the following year expenditures totaled 20.8 million yen, while revenues, including *goyōkin*, were only 10.5 million. After the clans were put down and the han (feudal district governments) were abolished, other expenses developed. The note issues of the han governments were assumed by the state, which also took over the debts of the daimyō

and had to provide indemnities for the Buddhist sects on their disestablishment. As a result, in 1872 expenditures totaled 58 million yen but revenues amounted to only 33 million yen. The expedition to Formosa and the Saga Rebellion in 1874 and the very serious Satsuma Rebellion of 1877 added to the burden of expenditure. The voluntary privilege given to the upper feudal classes in 1873 to capitalize and exchange their annual hereditary pensions for government bonds was made compulsory in 1876; this added 190 million yen to the public debt.

As E. Herbert Norman, chief of the postwar Canadian mission in Japan, states, "In Japan the feudal lord ceased to be a *territorial* magnate drawing his income from the peasant and became instead, by virtue of the commutation of his pension, a *financial* magnate investing his freshly capitalized wealth in banks, stocks, industries, or landed estates, and so joined the small financial oligarchy." The holders of pension bonds found banking an attractive field as a result of the liberalization of the national bank regulations in 1876. Consequently, between 1876 and 1880, 148 new national banks, all authorized to issue inconvertible paper money, were established.

In 1871, Assistant Secretary of Finance Hirobumi Ito (later Prince Ito), had been sent to the United States to study banking and financial institutions. As a result of his suggestions, and over the objections of the advocates of a European-style central bank, the Japanese National Bank Law, closely patterned after the United States National Bank Act, had been passed in 1872, mainly to unify the country's currency and to replace the inconvertible paper money with national bank notes redeemable in gold and silver. Until 1876 only four banks were established under this law, the most important being the First National Bank (Dai Ichi Kokuritsu Ginko), founded jointly by the Mitsui and Ono houses. (National banks took as trade names their Ministry of Finance registration number.) Specie holdings of the banks were required to amount to two thirds of their note issue, which was to be convertible. Since government inconvertible paper money emissions continued, specie began to command a premium and the national bank notes were immediately presented for redemption. As a result of this development, and to maintain the value of the bonds issued to the daimyō as a lump sum settlement for their hereditary pensions, the bank law revision of 1876 made it possible for the pensioned daimyō to use their government bonds to finance banking activities and suspended the specie convertibility requirement. The largest of the new banks, which sprang up in the banking boom which the new revision made possible, was the Fifteenth (Jugo) Bank, established in 1877 by a group of nobles, with a capital of 18 million yen. The new banks added 34 million yen to the inconvertible paper currency total, which by 1879 reached 170 million yen, while the total government debt rose to 254 million yen.

As a result of the steady increase in paper money and in government debt a violent inflation developed. The price of rice, by far the most important commodity, doubled between 1877 and 1880. Specie began to flow out of the country in large amounts. Anxious to adopt modern forms, the new government had established a gold standard in 1871. Patterned on the United States coinage law, the gold yen was defined

as containing 25.72 grains of gold, 9/10 fine. At the same time a 1 yen silver coin containing 416 grains of silver, 9/10 fine, was issued to be used exclusively at the treaty ports. (The silver yen was equivalent in metallic content to the Mexican silver dollar, then widely used in trade in the Orient.) The constant emissions of paper money and its depreciation, however, soon led to the disappearance of gold, and in 1878 the bimetallic standard was adopted, the government allowing the use of 1 yen silver pieces as legal tender throughout the country. In effect, however, the country was on a *de facto* silver standard. As the inflation developed, the paper money depreciated in terms of silver until by 1881, 1 yen of silver was equivalent to 1 yen 80 sen of paper. In October of that year, Count (later Prince) Masayoshi Matsukata was transferred from the position of minister of home affairs to that of minister of finance and financial conditions were taken in hand.

A New Foundation and Stability, 1881-1913.—Matsukata's first efforts were directed toward building up a specie reserve so that government paper money might either be made convertible or be retired. In 1880 the Yokohama Specie Bank (Yokohama Shokin Ginko), the first of a long line of special banks, had been established for the purpose of discounting foreign bills of exchange on the security of exported goods. The main object was, on the one hand, to encourage the direct export trade; on the other, to secure specie. The system worked poorly at first, but a revision in the bank's practices and procedures, instigated by Matsukata and made effective in March 1882, resulted in very considerable improvement, with the result that the government's specie reserve rose from 8 million yen in 1881 to more than 42 million yen at the end of 1885 and continued to grow thereafter. The government used its specie reserve gradually to retire its inconvertible paper money.

The next step was the establishment of a central bank, the Bank of Japan (Nippon Ginko), in October 1882. The bank's charter ran for an original term of 30 years; half of its 10 million yen capital was supplied by the government. Modeled after the National Bank of Belgium, the new bank issued convertible bank notes, held specie reserves of the national banks, acted as fiscal agent for the government, discounted the Yokohama Specie Bank's foreign bills, granted loans to subsequent special banks, and absorbed government bonds. It failed to act as a bankers' bank in the fashion of European central banks, nor did it exercise any extensive control over the money market, since its discount rate and open market policies were the result of treasury requirements more than of its own policies.

With the establishment of the central bank the task of retiring the national bank notes was begun. In 1883 the national bank law was amended to provide that the charters of national banks (originally issued for 20 years) should not be renewed, and that national bank notes were to be redeemed gradually with Bank of Japan convertible notes. National banks were gradually converted into ordinary banks, and 1899 saw the end of the last national bank. There followed the rapid growth in the number of ordinary banks (which did not have the note issue privilege, this now being confined to the Bank of Japan), and the increase in their im-

portance resulted in regulatory statutes being promulgated in 1890 and put into force in 1893. Under the Ordinary Bank Law, all banking institutions were placed under the control of the Ministry of Finance, which licensed new banks, controlled mergers, and generally supervised the conduct of banking business. The years 1893–1901 witnessed the greatest growth of Japanese banking. The number of banking institutions of all types increased from 703 in 1893 to 2,359 in 1901. In the latter year a panic occurred, causing a number of bank failures, especially among the small banks. As a result, the banking law was amended to provide that joint stock banks should have a capital of at least 500,000 yen, and private banks a capital of 250,000 yen. This measure encouraged bank consolidations, and by the end of 1913 the number of banks had declined to 2,156.

Matsukata's currency reform plans halted the inflation of the late 1870's, and the money contraction led to a severe depression, in 1883–1884. The price of rice fell sharply and farm discontent grew, but the government, despite protests, refused to be diverted from its task—to place Japan on a sound, convertible money basis. The redemption of the inconvertible notes continued steadily. The deflationary policy was mitigated somewhat by the concomitant depreciation of silver in terms of both gold and commodities. This continued decline of silver led to a rise in the price level, particularly in the early 1890's, and, since by that time Japan was conducting two thirds of her trade with gold standard countries, with the result that exchange rates were highly unstable, a commission was appointed in 1893 to study the problem. The commission recommended that the money base be changed and advocated a gold standard. In March 1895, Matsukata returned to the post of finance minister. In the following month Japan concluded with China the Treaty of Shimonoseki, which provided that China pay Japan a war indemnity amounting to 200,000,000 taels or £38,000,000 (360 million yen). This fortuitous windfall was utilized to enable Japan to adopt a gold standard. Arrangements were made to have this indemnity paid in sterling instead of in taels; part of the sum was brought back to Japan in gold and part was maintained in Britain as a foreign exchange reserve. By the Gold Standard Law of 1897, the unit of value, the yen, was fixed at 11.574074 grains of pure gold, equivalent to \$.49845 (pre-1934 dollar). By the end of the 19th century, therefore, Japan had stabilized her money structure by the adoption of the gold standard and by the retirement of practically all the government paper money and national bank notes.

Matsukata's view that the peculiar conditions of Japanese development required banks of a specialized nature in addition to the ordinary banks led to the establishment of the Hypothec Bank (Nippon Kwangyo Ginko) in 1897, the Bank of Formosa (Taiwan Ginko) and the Hokkaido Colonial Bank (Hokkaido Takushoku Ginko) in 1899, the Industrial Bank (Nippon Kogyo Ginko) in 1900, and the Bank of Korea (Chosen Ginko) in 1909–1911.

The Hypothec Bank, modeled upon the Credit Foncier of France and capitalized at 10 million yen, was authorized to make loans having a maturity of up to 50 years on the security of such immovable property as paddy and upland

fields, forests, and fishing rights. In addition, it might make loans to public authorities, co-operative societies, and agricultural and fishing associations and issue debentures up to 10 times (this was later increased) its paid-up capital. Such deposits as it accepted had to be invested in government bonds and bills of exchange. Simultaneously, 46 agricultural and industrial banks were established, one in each prefecture; they functioned as local subsidiaries of the Hypothec Bank. The bank is still in operation.

The Industrial Bank of Japan, modeled upon the French *Crédit Mobilier*, was established to carry out the government's policy of developing such new industries as the political and economic realities of the time required. As a result, it granted loans to the shipbuilding, public utility, iron and steel, chemical, and other heavy industries. As in the case of the Hypothec Bank, its loan funds were obtained by the sale of debentures, which were at first limited to 10 times its paid-up capital. Through the years the bank has served as an organ of state policy and has from time to time made loans considered to be in the strategic interest of the nation.

Another important financial agency, developed in the early days of the restoration and continuing to play an important role, is the Deposit Bureau of the Ministry of Finance, established in 1877 after the pattern of the British post office savings system. The bureau is entrusted with the very considerable postal savings and postal insurance funds of the Japanese people. The popularity of this method of saving among the large number of small depositors is seen by the fact that the system grew from about 300,000 depositors with 9 million yen of deposits in 1885 to 12 million depositors with 189 million yen of deposits in 1914. The Deposit Bureau gains its importance from the fact that it serves to funnel the mass savings of the whole people into investment channels favored by the state. The bureau invests its funds in government securities and in the debentures of the special banks. It has made loans to national policy companies, essential government-sponsored enterprises, and government-approved colonial projects.

In the field of public finance the national debt, which had risen sharply during the early unsettled years of the restoration and had reached 240 million yen by 1877, remained stable until the advent of the Sino-Japanese War of 1894–1895. The debt, which stood at 234 million yen in 1894, rose by 117 million yen as a result of the war and by 1903 reached 539 million yen (including about 100 million yen for the building of the national railways), of which 98 million yen had been borrowed abroad. The war against Russia (1904–1905) cost Japan about 1.5 billion yen, of which 1.2 billion yen was borrowed abroad. The alliance with Britain in January 1902 gave Japan greater access to the British capital market, and with Japanese military successes against Russia the borrowing rate in London fell from 6 per cent in 1904 to 4½ per cent in 1905. By 1907 the total Japanese national external and internal debt stood at 2.2 billion yen. Thus, as a result of two wars between 1894 and 1905, the national debt had increased tenfold. By 1914 it stood at 2.5 billion yen.

To meet growing central government expend-

itures, which rose elevenfold between 1869 and 1899 and by 1914 were three times the 1899 level, taxes were raised steadily. Under the shogunate revenues had come chiefly from the land tax, which was arbitrary in amount and payable in rice. During the 1870's land tax reform was undertaken. A capital value was fixed for each piece of land by capitalizing, at rates varying from 6 to 7 per cent, the net average produce of the unit over a five-year period, valued at then current prices. On such valuations a tax of $2\frac{1}{2}$ per cent was levied. Some 1,500 nuisance taxes were abolished, and by 1879-1880 four fifths of the whole tax revenue came from the land tax. Although the tax rate was raised to 5 per cent in 1899 and to as much as $11\frac{1}{2}$ per cent after the Russo-Japanese War, the growth of other taxes, mainly indirect, such as the liquor excises, the tobacco monopoly revenues, the customs, and stamp duties, brought the land tax receipts down to only one fifth of total ordinary receipts just prior to World War I.

World War I, 1914-1920.—Whereas in the years immediately prior to the war Japan had had an excess of imports and had experienced international financial difficulties and strains, the unparalleled wartime demand for her goods and services led to a sharp reversal of the trade balance. As a result, Japan's net credits on international account from trade and services aggregated over 3 billion yen between 1914 and 1919, or about 1 billion yen more than her total foreign indebtedness in 1913. She did not, however, use these foreign earnings primarily to repay debts owed abroad. Instead, she used them to make foreign investments, mainly short term, and to increase the combined gold reserves of the Bank of Japan and the Japanese government. These rose from 342 million yen at the end of 1914 to 2.1 billion yen at the end of 1920. Despite this rise in gold reserves, Japan in 1917 placed an embargo on gold exports, which was not lifted until January 1930. When the United States embargoed gold in September 1917, Japan was unable to convert her foreign credits into gold imports and the Japanese exchange bankers, principally the Yokohama Specie Bank, encountered great difficulties. Their advances to exporters were offset only by frozen credits overseas. As a result, they were forced to borrow from the central bank and sell their foreign holdings to it. The central bank's loans to the exchange banks grew from 44 million yen in December 1913 to 444 million yen at the end of 1918. As was to be expected, the note issue also rose sharply, from 385 million yen in December 1914 to 1.5 billion yen in December 1919. As Japan changed from debtor to creditor, prices climbed rapidly, industrial activity grew, real wages fell, and rice riots developed. Due to the war Japanese banks almost entirely took over the financing of Japanese foreign trade. Whereas in 1913 the Yokohama Specie Bank and the Bank of Formosa together financed 50 per cent of Japan's imports and 59 per cent of her exports, in 1918 they financed 95 per cent of the imports and 83 per cent of the exports.

As banking resources mounted during the war, a bank consolidation movement developed. Banks with a capital of less than 500,000 yen fell in numbers from 1,755 at the end of 1913 to 1,054 at the end of 1920, while those with a capital of 10 million yen and over rose from

15 to 46. Both the larger private banks and several of the special banks undertook operations in China during the war. The boom reached a peak in 1919, and as the year advanced a tightening in money conditions became apparent. Finally, in March 1920, the bubble burst and the stock market crashed, the index number of 120 leading securities falling from 250 in January to 165 in April. Commodity prices dropped and banks began to face runs and to fail. The Bank of Japan was forced to intervene and to grant liberal aid to distressed financial institutions, while the government aided basic industry by substantial advances from the Industrial Bank of Japan.

The Difficult Interwar Period, 1920-1931.

—Two additional serious banking crises and an attempt to strengthen the banking system by requiring more adequate minimum capitalizations led to a series of consolidations and mergers which, coupled with numerous bank failures, reduced the total number of banks from 2,285 in 1918 to 913 in 1930. A severe crisis developed with the occurrence of the earthquake of Sept. 1, 1923. Again the intervention of the Bank of Japan and of the government itself held the number of bank failures to a minimum and shortened the length of the moratorium, despite the fact that 76 of the 84 clearing banks of Tokyo lost their main offices in the earthquake. The government agreed to reimburse the Bank of Japan to a maximum of 100 million yen for any losses incurred in the discount of bills in the stricken area. As a result, the Bank of Japan extended credit to banks on far more liberal terms than usual and discounted large amounts of what were called "earthquake bills." Loans and discounts of the Bank of Japan rose from 580 million yen at the end of 1922 to 862 million yen at the end of 1923. The next, and most severe, crisis came in April 1927. On April 28, the Fifteenth or Peers Bank, one of the five largest, failed and some 36 large banks and many smaller ones immediately followed suit. A special session of the Diet authorized the Bank of Japan again to come to the assistance of the banks and provided government indemnification for any losses the bank might sustain.

The bank failures were due in part to the nature of the banking operations in which the Japanese ordinary private banks, especially the country banks, were engaged. Their assets consisted mainly of promissory notes backed by collateral not easily liquidated because it represented long-term loans to industry and agriculture, particularly advances on mortgages of land and buildings. Entry into this hazardous type of banking business was partly due to failure to develop the bankers' acceptance and a discount market. Also responsible was the shortage of high-grade stocks or bonds, which resulted from the fact that so many of the great business undertakings were in the hands of the *zaibatsu*, which seldom resorted to the securities market. There was no popular tradition in Japan of security ownership, only a rudimentary capital market, and almost no investment banking mechanism in the Western sense.

The banking law was amended in 1927 to double the minimum capital requirements of banks. Banks in Tokyo and Osaka had to have a minimum of 2 million yen capital; other banks, 1 million yen. Government powers of bank inspection were strengthened. The crisis and the

higher capital requirements stimulated the bank consolidation movement. In the 18 months following the April 1927 banking crisis, 328 banks were absorbed by consolidations. By the end of 1928 the "big five" banks (Mitsui, Mitsubishi, Dai Ichi, Sumitomo, and Yasuda) held 34 per cent of the deposits of all ordinary banks in Japan.

Japan's desire to return to the gold standard after World War I was thwarted and delayed by losses of gold reserves, by an excess of imports over exports, and by the fact that she once more became a borrowing country. From 1920 to 1929 Japan paid out the balances accumulated abroad during the war and sold her bonds abroad. The specie holdings of the government and of the Bank of Japan fell from 2 billion yen at the end of 1919 to 1.1 billion yen in March 1929. In the summer of 1929 the Minseito Party assumed power with Junnosuke Inouye as finance minister. Minister Inouye, who had long advocated classical financial principles, announced his intention of removing the gold export embargo and of restoring the gold standard. On Jan. 11, 1930, the gold embargo was removed, officially re-establishing the old prewar gold parity of \$49845 per yen. The timing of the attempted return to the gold standard was unfortunate, and it was followed by an extremely severe deflation, the Bank of Japan's index of wholesale prices falling from 155 in December 1929 to 110 by the end of October 1931. The gold reserves of the Bank of Japan fell from 1,072.3 million yen at the end of 1929 to 469.5 million yen at the end of 1931. Inouye persisted in attempting to balance the budget, even to the extent of reducing military and naval expenditures. Agrarian and military discontent grew, and the government fell in December 1931. Two months later, Inouye was murdered by "patriotic elements."

War Economy, 1931-1945.—The new government of the Seiyukai Party immediately reimposed the gold embargo and introduced control over international capital transfers and foreign exchange transactions by means of the Capital Flight Prevention Law of July 1, 1932 and the Foreign Exchange Control Law of May 1, 1933, later revised several times. The new finance minister, Korekiyo Takahashi (who served from May 26, 1932 to Feb. 26, 1936), initiated a deflation policy whereby mild deficits were incurred to stimulate the economy. The sharp growth in military expenditures provided an inflationary filip. The total army and navy budget rose from 434 million yen in 1931 to 7,266 million yen in 1940. The military budget, which represented 29 per cent of total expenditures in 1931, rose to 75 per cent of total expenditures in 1938. Naturally, military expenditures on this scale could not be financed out of current tax revenues. Deficit financing caused the total national debt outstanding to rise from 6.8 billion yen on March 31, 1931 to 31.1 billion yen on March 31, 1941. The necessity of absorbing this expansion of the public debt, as well as of meeting the capital demands of the expanding munitions industries, led to a material increase in the expansion of bank credit despite a sharp decrease in the number of banks. While the number of ordinary commercial banks declined from 782 to 186 between Dec. 31, 1930 and Dec. 31, 1941, deposits rose from 8.7 billion yen to 29.8 billion.

Early in 1936, Takahashi announced that re-

covery had been achieved and that the time had come to call a halt to inflation. He was assassinated shortly thereafter and his successor proved more amenable to theories of military economics. Takahashi had kept the budget within 1.9 to 2.2 billion yen. After his murder it was doubled and then rose even more sharply to 18.7 billion yen in 1941-1942. He had considered 600 million yen a safe limit for government deficits, but the deficit was increased to 1.5 billion yen in 1937-1938 and to 6.9 billion yen in 1941-1942. He had believed that the inflationary influence of government deficits could be minimized if banks and investment institutions invested the liquid funds they created in government bonds. This "capital circuit," he believed, would result in easy money and declining interest rates but would check an increase in the Bank of Japan note issue. During the new era in Japanese fiscal policy, which his murder inaugurated, the note issue of the Bank of Japan rose from 1.7 billion yen (Dec. 31, 1935) to 5.9 billion yen (Dec. 31, 1941).

The beginning of the active war against China in 1937 saw a sharp intensification of government control over the financial apparatus. A variety of measures were adopted, beginning with the Temporary Funds Adjustment Law of September 1937, to direct capital and credit into the war industries and to dry up the flow to the nonessential industries. Toward this end, effective use was made of the special banks, particularly the Industrial Bank of Japan, whose borrowing power was expanded to make possible extensive financing of government-sponsored munitions and overseas projects and national policy companies. Financial institutions and security underwriters were required to obtain permission from the Ministry of Finance either when making long-term loans or when subscribing to or underwriting securities. In August 1941 a munitions bill acceptance system was established.

In the 55 years of its existence prior to 1937, the Bank of Japan had adhered to what was considered relatively orthodox central banking practice. In the ensuing 5 years, culminating in the new Bank of Japan Act of 1942, every orthodox tenet of central banking was violated, and the bank took on every conceivable financial task, including long-term industrial financing. By the end of 1941 total assets of the bank, which had stood at 2.4 billion yen on June 30, 1937, reached a new high of 7.7 billion. This expansion was attributable for the most part to the growth in government bond holdings, which rose over the same period from 880 million yen to 5.3 billion yen, an increase of 507 per cent. By the end of 1941 the bank had been almost completely converted into a tool for government war finance.

Government control over the financial system was tightened greatly after Japan's entrance into World War II. The charter of the Bank of Japan, which had been renewed for an additional 30 years in 1912, expired early in 1942 and the government took the opportunity, in the act renewing the charter indefinitely, to place the bank completely under the control of the minister of finance. It also increased the bank's lending power by removing most of the remaining provisions regarding necessary kinds of security. The National Financial Control Association (Zenkoku Kinyu Tosei Kai) and a number of subsidiary control associations were established in 1942. The association acted as a central advisory and coordinating organization between the minister of

finance and the various financial institutions. Its principal function was participation in the formulation and application of the government's yearly financial plans for (1) the collection of savings, (2) the issuance of corporate debentures, and (3) the absorption of government bonds. These plans were the main basis for government wartime financial programming. They set savings goals, allocated savings quotas, and established government bond absorption targets. The National Financial Control Association was entrusted by the Finance Ministry with the task of carrying out the Ordinance for the Consolidation of Financial Institutions of 1942, which gave the finance minister broad powers to bring about amalgamations of banks, trust companies, and other financial institutions. Under this program consolidation was carried forward vigorously, and by Aug. 31, 1945 the number of ordinary banks had been reduced to 61 (from 186 at the end of 1941) and the number of savings banks to just 5 (from 69 at the end of 1941).

A variety of new financial institutions were established to assist in various phases of war finance. The most important was the Wartime Finance Bank (Senji Kinyu Ginko), which, capitalized at 300 million yen, was patterned after the Industrial Bank of Japan and performed somewhat similar, though (perhaps) what at the time appeared to be more speculative, functions. The formation of the Munitions Ministry in 1943 led, in 1944, to the establishment of the munitions company financing system, under which companies performing basic war production functions were assigned to designated banks, which were then responsible for meeting their financial needs. These loans were in turn guaranteed by the government.

Despite a basic tax revision in 1940, which attempted to give central importance to the income tax as the chief revenue producer, Japan, in contrast to Great Britain and the United States, made no serious attempt to finance the war by any appreciable degree of taxation. The proportion of Japanese government revenues to expenditures, which stood at 74 per cent in 1936-1937, declined to 24 per cent in the fiscal year 1944-1945—a clear indication of the increasing degree of Japan's dependence on deficit financing. The resultant growth of the national debt carried it by the end of the war to 177 billion yen, or 17 times greater than the prewar (1936) figure of 10.3 billion yen. The absorption of so large a deficit year after year expanded the credit base and brought on some degree of inflation, particularly in the last year of the war. Money in circulation in Japan rose 785 per cent between 1940 and 1945, in contrast to the 240 per cent increase in the United States. The ballooning of the whole financial system in Japan is seen in the growth of the total assets of all ordinary banks. These increased by 27.5 billion yen during the Sino-Japanese War period and by approximately 100 billion yen during the World War II period.

Finances in Defeat and Reconstruction, 1945-1954.—The pent-up inflationary pressures, which had been partly restrained and repressed during the war, broke loose with the collapse of Japanese governmental authority. Partly because of uncontrolled disbursements in the months immediately after surrender, the note issue doubled between August 1945 and February 1946, and prices rose 295 per cent. As a result, occupation authorities formulated a control program, which

included a currency conversion program, the freezing of deposits, 100 per cent taxation of war indemnities, a capital levy, and the establishment of an economic stabilization board.

The currency conversion plan carried out in March 1946 temporarily reduced the currency in circulation from 62 billion yen in late February 1946 to 15.2 billion yen on March 12, 1946, but it had no lasting influence. By September 1946 the volume of new note issue had reached 64 billion yen, surpassing the preconversion peak. As a result of the conversion, some 45 billion yen were frozen in old yen blocked accounts in the banks.¹ Since individuals were permitted to convert only 100 yen per person, all additional yen had to be deposited in the blocked accounts. Withdrawals from these old yen blocked accounts were limited by the Ministry of Finance, although no restrictions were placed upon the deposit or withdrawal of new yen. In August 1946 the old yen blocked deposits were divided into first and second blocked accounts, because with the cancellation of war indemnities many of the corporations had become technically insolvent and could not repay their wartime loans, nor was the government permitted to make good its guaranty of these loans, thus rendering the majority of banks technically insolvent. Under a series of emergency financial laws steps were outlined under which both banks and corporations were to reorganize, write off their unrealizable wartime assets and liabilities, increase their capitalizations, and begin anew. In the case of the banks, losses were written off by canceling the bulk of the second blocked deposits. This reorganization process was completed by mid-1948, at which time all restrictions were removed from the first blocked deposits and from such part of the second blocked deposits as were not needed to offset losses. Most of the banks were recapitalized at this time, and the formerly *zaibatsu*-named and -controlled banks changed their names, although the original names were restored shortly after the end of the occupation in 1952.

A new financial institution, the Reconstruction Finance Bank (RFB), was established in October 1946; it began operations in January 1947. While its original purpose had been defined as the financing of Japanese industry's requirements for new and replacement capital goods, its funds were used more and more to meet the ever-increasing working capital needs of Japanese business, as operating deficits grew larger and larger with the inflationary distortion of costs. The outstanding loans of the bank rose from 4.1 billion yen in January 1947 to a peak of 132 billion yen in March 1949, at which point its activities were curtailed, for it had become a prime vehicle of inflation, and its outstanding loans were a kind of side-pocket government deficit.

The mounting inflation which characterized the first few years of the postwar period caused growing concern among Allied occupation authorities. By May 1949 the price level was some 200 times the prewar 1934-1936 base. Note issue of the Bank of Japan had risen twelvefold since the surrender. Budget deficits grew. National debt rose from 128 billion yen at the end of 1944 to 575 billion yen at the end of 1949. Despite an occupation-sponsored capital levy, a 100 per cent tax on war indemnities, and reform of the income, capital gains, estate, and gift taxes, in 1946-1947

¹ On Jan. 21, 1946, the government froze all bank deposits of business corporations.

tax revenues failed completely to keep pace with mounting expenditures.

Alarmed at this prospect, the United States Departments of State and of the Army publicly directed the supreme commander for the Allied powers (SCAP) to order the Japanese government to "carry out an effective economic stabilization program calculated to achieve fiscal, monetary, price and wage stability in Japan as rapidly as possible." Accordingly, a nine-point economic stabilization program was adopted in late 1948 and, in early 1949, Joseph M. Dodge, former president of the American Bankers Association and president of the Detroit Bank, was sent to Japan, with the rank of minister, to see that the financial rehabilitation program was developed effectively.

The achievements of the first Dodge mission may be summarized as follows: (1) It ended deficit financing and produced a balanced budget for the first time since 1930. (2) A single foreign exchange rate was set at 360 yen to the U.S. dollar. In the mid-1930's the yen had been worth about 28 cents and immediately after the surrender a military conversion rate of 15 yen to \$1 had been established. This was raised to 50 to 1 the following year, and in mid-1948, with the advance of inflation, to 270 to 1. For the conduct of foreign trade a complex multiple exchange rate structure had been in effect. (3) The deficit loans and enormous credit expansion activities of the RFB were halted. It was required that all RFB debentures be retired by the end of the 1949-1950 fiscal year and that new loans by the RFB be permitted only to the extent of repayment of outstanding loans. (4) Stock markets in the principal cities, which had been closed since the end of the war, were reopened in order to stimulate the flow of capital into industry and to maximize security investment. (5) The control and management of the Bank of Japan was reorganized. A policy board of seven members, modeled after the board of governors of the United States Federal Reserve System, was established. The purpose was to free the bank from domination by the Ministry of Finance. The functions of the board include the determining of policies of basic credit control, open market, discount rate, loans, and other matters, which the bank then carries out.

Shortly after Dodge left in April 1949, a tax mission, headed by Professor Carl S. Shoup of Columbia University, arrived in Japan. Its recommendations, contained in an exhaustive four-volume report, increased the emphasis upon the income tax as the main source of Japanese national government revenues, reorganized the tax on corporate profits, and gave the local governments independent tax sources of their own, principally a revised real property tax. Dodge returned to Japan in November 1949 to ensure that the budget for the fiscal year 1950-1951 remained balanced.

Until the outbreak of the Korean War in June 1950, Dodge's program halted the inflationary spiral. From this point on, however, prices began moving upward again. The budget became unbalanced once more, but taxes continued to be reduced. The banks overextended themselves by making illiquid long-term capital loans to industry. Bank of Japan note issues soared again, and by 1954 wholesale prices were more than 50 per cent above June 1950 levels. As a result, the government in 1954, undertook a new program

of fiscal restraint, designed to balance the budget, limit government capital outlays, and lower prices.

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11. GOVERNMENT. Japan passed through a period of political experimentation unprecedented in history in the nearly seven years of military occupation following the close of World War II in 1945. Whatever the lasting effects of this interesting experiment may be, they can be viewed in proper perspective and evaluated accurately only after a considerable passage of time.

The national program of westernization adopted in the 19th century never had the opportunity to achieve full and natural development, since it was at best a superficial adoption of the organization and structure of European and American institutions. This resulted in façades which concealed traditional concepts and attitudes that were much too deeply rooted to be easily superseded by alien ideas and ways of doing things.

While the Japanese governmental structure before World War II was as Western and modern as any in Europe or America, the concepts and attitudes which constituted the mainsprings of government and politics bore little if any resemblance to those of the West. Nor could the behavior and actions of the leaders or the people be judged in terms of Western patterns or standards of value. Needless to say, the inception of the modern Japanese political system was impelled more by external pressures than by internal needs to establish a Western type of constitution and a parliamentary government. In the carefully planned and executed modernization of the nation's administrative machinery, the primary objective was the achievement of such overall organization as would ensure a high degree of efficiency and a rapid development of industrial and military power. Inevitably emphasis fell on organizational modernization, which influenced only very slightly traditional ideas.

It was natural that the Meiji Constitution of 1889, which clothed Japanese government in Western garb, should have been not an instrument designed primarily to secure the inalienable rights of the individual, but rather a means of achieving national strength and international recognition. Western concepts of liberty and popular rights which were then espoused had been acquired largely out of context and without the benefit of the necessary environment which only working institutions and practices could render meaningful. Traditional ideas and attitudes continued to dominate political thought, unaffected by the remarkable scientific and technological advances which had been attained in the meantime. In fact, old ideas were refurbished to serve the needs of the nation, especially in molding a new nationalism adequate to cope with the rising tide of nationalism of the 19th century world.

See also section on *Development of the Modern State*.

Constitution of 1947.—The Japanese Constitution which went into effect on May 3, 1947 charts in broad outline a democratic political system. As an incorporation of the principles and objectives of the Potsdam Declaration of July 26, 1945, its goal is a peaceful and democratic nation, a political system based on the freely expressed will of the people. Sovereignty is vested in the people: this is a complete reversal of the monarchical principle of the Meiji Constitution and a negation of the traditional theory which held that sovereignty resided irrevocably and permanently in the emperor. The affairs of the imperial household are under the control of the national Diet. The bureaucratically operated authoritarian political system, which was not responsible to the people, has disappeared and the peerage has given way to a system of equality in which no special privileges are permitted. Respect for the dignity of the individual is firmly established in a Bill of Rights which is very specific in its provisions.

With the adoption of legislative supremacy as a basic principle, the Diet has been made the highest organ of the state. Separation of power has been established in substance, while a system of checks and balances has been introduced for the first time, together with such democratic devices as the referendum and recall. The doctrine of judicial review is an integral part of the system in which the independence of the judiciary exists in fact.

In establishing the principle of the supremacy of law, the Constitution of 1947 places legal control over administrative acts through the exercise of judicial power. Formerly the executive branch transcended judicial control and was not subject to any check over its administrative acts. Sanctity of laws has superseded the idea of the practically omnipotent ruler, giving to the Japanese for the first time the principle of "government of laws" instead of the "government of men" which had been their tradition.

Undoubtedly the most unique feature of the Constitution is the provision completely renouncing war as an instrument of national policy. This unprecedented step attracted worldwide attention and has been characterized by some as utterly unrealistic and utopian and hailed by others as a beacon light to the troubled world.

The new constitution of 103 articles is only slightly longer than the old, but, despite the insistence of some Japanese that it is a mere revision, it represents a radical change in substance. The preamble is reminiscent of the Declaration of Independence, the Preamble to the Constitution of the United States, Lincoln's Gettysburg Address, and the Atlantic Charter, all of which inspired those who drafted the constitution. Highly significant is the use of the simple colloquial style of Japanese. The abandonment of the stilted and difficult court style formerly used for decrees and proclamations represents another definite step toward democratization.

National Diet.—As the highest organ of national power, the legislative branch is supreme over the executive. The Diet has become the sole lawmaking organ of the state, stripping the executive of the emergency ordinance powers which it used extensively under the old constitution to the detriment of the legislative branch. Sovereignty used to be vested exclusively in the emperor, who was the source of executive, legisla-

tive, and judicial power; the Diet could not legislate without imperial approval, and the initiative in lawmaking rested with the executive branch.

Under the Constitution of 1947 the Diet not only legislates, but also designates the prime minister from among its own membership and possesses exclusive initiative in proposing constitutional amendments. Fiscal powers, including the power to tax, belong to the lower house, whose approval is necessary for emergency appropriations. Control of foreign relations is also vested in the Diet, and its approval is necessary for the ratification of treaties. Through the exercise of investigative power, control over imperial household property, and the power to impeach judges, the Diet's position is greatly strengthened.

As is customary on the national level, a bicameral legislature is provided, but the upper chamber, the House of Councilors, has become entirely elective. The two houses, however, do not have equal powers. Formerly the appointive House of Peers could obstruct the enactment into law of any bill passed by the elected House of Representatives. Now the lower chamber has superiority over the upper chamber in appropriations and fiscal matters, in foreign relations, and in the selection of the prime minister, and may easily override the actions of the latter. The House of Councilors has no power to do anything about a bill which has been defeated by the House of Representatives. If the House of Councilors should either fail to pass or attempt to modify a bill already passed by the House of Representatives, however, the latter can enact it into law by a two-thirds vote.

Despite the strong powers it possesses, the House of Representatives is subject to dissolution by the Cabinet, while the House of Councilors is not. This provision gives the latter both stability and continuity and, in spite of its relatively weaker powers, it has attracted to its membership persons of experience and prominence largely because of its prestige, which is at least partly a carry-over from the old House of Peers. Of the 250 members of the House of Councilors, 100 represent the nation at large, while the remaining 150 represent the prefectures, each of which has two to eight seats. Councilors are elected for a term of six years, one half of the membership being chosen every three years. The membership of the House of Representatives remains at 466, as formerly, and the members all represent the prefectures, which are divided into one to five election districts, except for Tokyo, which has seven. The term of office is four years, and the entire membership stands election simultaneously.

One regular session of 150 days must be held every year. It usually opens in early December and may be extended whenever necessary beyond the five-month period. Extraordinary sessions are called as needed, the duration being decided each time by both chambers. As a rule, sessions and even committee meetings are open to the public except when secrecy is decided upon by a two-thirds vote. Decision is by simple majority. The lawmaking procedure in the Diet is very similar to that of the United States Congress, as are its rules of procedure.

Executive.—In the administrative branch simplification has been achieved through the reconstitution of executive organs. Gone are the Privy Council, the lord keeper of the privy seal, and

the minister of imperial household, all of whom exerted powerful influence on national policy making as well as on the management of state affairs. As "the symbol of the State and of the unity of the people," the emperor has no powers related to the government and performs only ceremonial functions. The only important executive organ now is the Cabinet, headed by the prime minister, who is chosen by the Diet from its own membership. The premier is required to select at least half of his Cabinet from the Diet. The Cabinet, which is collectively responsible to the Diet, enjoys greater powers than it ever did before. Furthermore, the constitution clearly defines its functions, powers, and responsibilities, which include administration of laws, conduct of state affairs, management of foreign affairs, preparation of the budget, issuance of Cabinet orders, and decisions on amnesties, commutations of punishment, reprieves, and the restoration of rights.

As head of the government and representative of the Cabinet, the premier submits bills and the budget and reports on the state of the nation and foreign relations to the Diet; exercises control over the administrative departments, determines their jurisdiction and powers, and sets aside their acts and orders; acts for his ministers during their absence or holds portfolios concurrently; issues Cabinet orders; and has exclusive control of the office of the prime minister. He is thus the actual head of the Cabinet and not merely a moderator-coordinator.

Several important changes have been effected in the component executive departments of the government since 1945. In late August, immediately following the surrender, the Munitions and Greater East Asia ministries were abolished. The first postwar innovation was the creation, on Sept. 1, 1947, of the Ministry of Labor, designed to achieve the stabilization of national livelihood and social security through labor administration. The most significant of all the organizational changes was the liquidation, on Dec. 31, 1947, of the Ministry of Home Affairs, which had, through extensive appointive and police power and control over prefectural assemblies, imposed the will of the national government upon local political entities and left little room for actual self-government. The abolition of the Home Ministry removed the stronghold of bureaucracy and nerve center of highly authoritarian national government and prepared the ground for popularly based and democratically managed local government. This action was followed by the creation, on Feb. 15, 1948, of the Office of the Attorney General, which superseded the Ministry of Justice. The change effected the complete separation of investigative and judicial functions and a more logical allocation, as well as an expansion, of functions.

The Ministry of Construction was established on July 10, 1948 to take over such functions of the Home Ministry as those pertaining to rivers, public works, city planning, buildings, and construction, particular emphasis being given to the reconstruction of war-damaged areas. On May 25, 1949 the Ministry of International Trade and Industry superseded the Ministry of Commerce and Industry, effectuating a shift in policy from the emphasis on general production to concentrated efforts on the promotion of international trade and, particularly, the production of foreign trade commodities. Last in the series of changes was the splitting, on June 1, 1949, of the Com-

munications Ministry into two departments: Postal Affairs and Electrical Communications. The Cabinet then comprised the following ministries: Foreign Affairs, Office of the Attorney General, Finance, Education, Welfare, Agriculture and Forestry, International Trade and Industry, Transportation, Postal Affairs, Electrical Communications, Labor, and Construction. In 1952 the Office of the Attorney General resumed the name of Ministry of Justice, and the Ministry of Electrical Communications was abolished, most of its functions being transferred to the Ministry of Postal Affairs.

Executive power, formerly supreme, now is not only subordinated to the legislative, but is also subject to judicial review. The police is no longer the strong arm of the executive branch. Nor is executive power bolstered by a special court to handle administrative disputes and render decisions favorable to it, for the Court of Administrative Litigation has been abolished. The power to determine the organization of the executive branch has been transferred to the Diet from the emperor, whose exclusive prerogative it had been. Government officials are no longer the officials of the emperor, to whom alone they were responsible and loyal; they are public servants answerable for their actions to the people through the Diet.

The civil service has been removed from the direct control of the Cabinet and placed in the hands of the National Personnel Authority to insure greater rationality, efficiency, and economy as well as to preclude any sort of spoils system. Grades are based on functions rather than on personal status and rank, and the principle of equal pay for the same work has been adopted. Appointments and promotions are based on competitive examinations. In spite of these organizational changes designed to bring about a democratically controlled administrative machinery, however, bureaucratic-feudalistic attitudes and practices still persist as serious obstacles to the democratization of the political system. The tendency to judge individuals on the basis of former court ranks, service grades, decorations, and the like is still apparent. So are the ideas and attitudes of a considerable segment of the bureaucracy, which reflect their unwillingness or inability to grasp or even to tolerate democratic ideas and processes, their negation or denial of political parties, their persistence in the mystical concept of the state, which they try to impose on the public, and their reluctance to give up the theory of absolute monarchy.

Although the Diet is the sole lawmaking organ, initiative in national policy making is held by the Cabinet, which enjoys the legal right to draft and submit bills to the Diet. The Cabinet has consistently played a dominant role in the constitutional and legal changes effected in the period since the surrender, while the Diet has not asserted by anything approaching vigorous action its right to formulate policies through the law-making process. On the contrary, the lawmakers have deferred their prerogative to the Cabinet by default rather than by delegation of powers.

Judiciary.—There has been a radical change in the administration of justice both in concept and in procedure. Previously resort to law courts was regarded as disgraceful and was scrupulously avoided by the public. Because of traditional biases, the natural inclination of an individual was to avoid altogether the use of the judicial

machinery and to settle disputes out of court. Law courts were seldom if ever regarded as courts of justice. Under the new system the independence of the judiciary has been firmly established, and there no longer exists administrative or executive control of the courts. Furthermore, the democratization of courts and trials which has been undertaken increases respect for individual rights and dignity.

In recognition of the new status of the judiciary, the chief justice of the Supreme Court has been accorded a rank equivalent to that of the prime minister. The doctrine of judicial review gives the court the power to declare laws unconstitutional, making it the guardian of the constitution. An innovation of note in the judicial system is the device of referendum employed in determining the fitness of the judges of the Supreme Court. On the theory that the judges of the highest tribunal must reflect the collective will of the people, the constitution provides that they shall be reviewed "by the people at the first general election of the members of the House of Representatives following their appointment, and shall be reviewed again at the first general election of the House of Representatives after a lapse of 10 years and in the same manner thereafter." If the dismissal of a judge is favored by the majority of voters, the popular mandate must be carried out. In addition, impeachment is provided against judges as well as against all officials.

Of the 15 judges of the Supreme Court, 10 must be legal experts of at least 20 years' professional standing, but the remaining 5 may be learned persons of experience, though not necessarily in the field of law; this permits a democratic representation of expertness. Below the Supreme Court are the eight higher courts, which are regional courts of appeal, and below them are the 48 district courts—1 in each of the 46 prefectures except Hokkaido, which has 3 in order to cover its large area. At the lowest level are the 600 newly created summary courts, with jurisdiction in cases involving not over 5,000 yen. They are designed to simplify legal procedure and to overcome the public dislike of courts as well as the stigma attached to litigation itself.

A distinct innovation is the court of family relations, which was set up on Jan. 1, 1948 to maintain harmony within the family as an institution. The new arrangement is designed to help advance both the dignity of the individual and the equality of the sexes. Matters handled by the 276 courts of family affairs include divorce, breach of promise, alimony, mutual support, guardianship, adoption, property settlement, and the like. After the establishment of these courts, the number of cases brought by women increased greatly.

For the first time a complete separation of criminal investigation and judicial functions has been achieved in Japan. Under the old system the procurators were attached to and subservient to the courts, but now investigations are conducted independently of the courts. Summary punishments, which used to be administered by the chief of a police station and which gave rise to numerous and serious abuses, have been abolished. Both the preliminary investigations and the forced confessions, which were conspicuous features of the old system, are gone. The legal validity of confessions has been greatly reduced,

while habeas corpus as well as the double jeopardy clause have been accepted as an integral part of the judicial procedure.

Local Government.—Local government formerly was no more than an administrative adjunct of the central government. Since the old constitution neither denied nor guaranteed local autonomy, and since it was subject to the vicissitudes of shifting political fortunes, government at the prefectural level suffered from a lack of stability. Moreover, local government was controlled at will by the bureaucracy. The authorities discouraged, if they did not forbid, party politics from the prefectural level downward in order to keep a firm grip on local governmental activities. Consequently, popular participation seldom, if ever, went beyond periodic casting of votes in the national, prefectural, and local elections. Once this was done, local self-government was managed by elected assemblies which were controlled by prefectural governors, who executed orders and instructions emanating from the Ministry of Home Affairs.

It had been the practice for prefectural governors appointed by the Home Ministry to be transferred with each change of government and with only incidental regard for the well-being and interests of the people. Governorships were at best steppingstones for ambitious bureaucrats. Their attitude of superiority, if not of condescension, was reflected in their officiousness and contempt for the people, who knew only the form and not the substance of local government. Moreover, what little semblance of local autonomy there existed was taken away beginning in 1943 by a reorganization which made local entities an integral part of the central government. This was done in the name of all-out prosecution of the war. The central government thereafter became supreme in the sphere of local government, and any pretense of local autonomy was dropped completely.

It was to correct these conditions and to permit greater and direct participation in self-government that the Local Self-Government Law was enacted by the Diet in March 1947. It was clear that the effective democratization of the nation must begin at the grass-roots level. Every possible means had to be utilized to encourage the people to participate in politics by arousing them from political apathy, and to insure a broader base for local government and politics. Decentralization of administration was a necessary prerequisite to the growth of self-government.

The local government system adopted in 1947 provides for the direct election of governors and of mayors of wards, municipalities, towns, and townships. Local government has lawmaking powers, police powers, financial powers (including the power to make public levies in emergencies), and control over education through local commissions elected directly by the people. Twenty-one enumerated categories of powers are exercised by local government, while only eight are reserved exclusively for the central government. Residual legislative powers accrue to the local government. Yet the fact that the drafting of the Local Self-Government Law enacted by the Diet was left almost completely in the hands of the Home Ministry virtually on the eve of its demise, with only a perfunctory, ineffective participation by the Diet, left much to be desired.

Direct measures such as the initiative, referendum, and recall make possible a much greater

participation on the part of the people. The electorate can also demand the dissolution of local assemblies and the examination of records and the auditing of books. In order to broaden the political base the voting age was lowered from 25 to 20 years, women were given equal voting rights, the residence requirement was reduced to six months, and bankrupt and financially dependent persons and charity cases were given the right to vote. By these changes the number of voters was trebled.

Local legislative bodies are unicameral and members are elected for four-year terms. Prefectural assemblies have from 40 to 100 members, depending on the population. The metropolis of Tokyo has a distinctive metropolitan government which is a combination of municipal and prefectural types. The city of Tokyo itself does not have the ordinary type of municipal government; it and the rest of what was formerly Tokyo Prefecture are under a single metropolitan government.

Police System.—The old police system was employed as an effective instrument by the military as well as by the bureaucracy, since the Meiji Constitution enabled the government to exercise police power with great flexibility over all areas of the life of the people. It was for the protection of the interests of the state, and at the expense of individual rights, life, and property, and social security that this power was extensively used, contributing directly to the strengthening and expansion of the authority of the central government. The constitutional rights given to the people could be restricted or nullified by legislation. Freedom of speech, assembly, and association was restricted by police power through the various thought-control laws, of which the best known was the Peace Preservation Law of 1925, aimed at Leftist movements in general and communism in particular. Laws enacted before and during World War II served to tighten further already existing controls over freedom of speech, the press, assembly, and association.

One of the initial acts of the supreme commander for the Allied powers (SCAP) was the abolition, in October 1945, of the special higher police of the Home Ministry, which had been in charge of thought control. Political offenders were released immediately, and the notorious Peace Preservation Law and all other restrictive laws were abolished. This series of measures was climaxed by the abolition of the Home Ministry, bringing the police state to an end.

Police power has been reduced to normal proportions by the delimitation of its scope to the prevention, search, and suppression of crime, and to the protection of life and property. As a result, the police relinquished administrative jurisdiction over matters relating to labor, health, social insurance, and the control of economic matters, all of which were transferred to appropriate administrative departments. Police power has been made subject to the close scrutiny of the regularly constituted courts of law and must be exercised within the specific limits set by law. In keeping with the principle and spirit of local autonomy, as well as with the realization of the highest degree of the dignity of the individual, decentralization of the police has been effected.

Beginning in March 1948, each city or urban section of a town or township with 5,000 or more inhabitants was authorized to maintain a

local autonomous police force under the supervision of a local public safety commission. By 1953, of the 2,303 towns and townships, only 206 still had their local police forces. Of the 276 municipalities, nearly one fifth were leaning toward abandoning their own police forces and coming under the protection of the national rural police, which is under the overall supervision of the National Public Safety Commission, appointed by the premier with the advice and consent of the Diet. In 1952 the premier was given the power to control the nation's entire police force in the event of an emergency. Two years later, on June 7, 1954, the Diet passed a bill abolishing the autonomous police forces and renationalizing all police powers.

Abuses of police power under the new system have been made difficult by the provisions that no one may be detained longer than 72 hours, that the reason for detention must be given, and that the opportunity to secure counsel must be offered. Through the constitutional prohibition of the use of the third degree, police brutality has become illegal. An interesting change has been the appointment of women police officers for the first time in Japanese history, and with satisfactory results.

National Defense.—Demilitarization, which was one of the conditions of surrender in the Potsdam Declaration, had been initiated by the Japanese themselves even before the Allied initial postsurrender policy was effectuated. On Aug. 22, 1945 the Supreme Council for the Direction of War was abolished, and a few days later the Munitions Ministry was also abolished. On September 2—the day of the formal signing of the Instrument of Surrender—SCAP ordered the disbanding of the armed forces by General Orders No. 1. Within a fortnight the Imperial Headquarters was liquidated. Demobilization of troops in Japan proper was completed by mid-October and was followed shortly by the abolition of the army and navy general staffs. The military conscription system came to an end on November 17, and the War and Navy ministries were abolished on November 30. Within three months, complete demobilization and demilitarization had been successfully achieved.

Undoubtedly the most conspicuous feature of the new constitution is the absolute and unconditional renunciation of war as a sovereign right of a nation, thereby outlawing the use of threat as well as of force itself as a means of settling international disputes. The requirement that the prime minister and all Cabinet ministers must be civilians excludes the military from participation in the government. For the first time in Japan's constitutional history, the influence of the military has been removed completely from government.

In spite of the complete demilitarization of the nation provided in the constitution, the right of national self-preservation has been explicitly conceded to Japan. On Jan. 1, 1950, Gen. Douglas MacArthur stated that Japan has "the inalienable right of self-defense against unprovoked attack." In July of that year, following the outbreak of the Korean War, a police reserve was created, and on Oct. 15, 1952, this became the National Security Corps. Chapter 3 of the Japanese Peace Treaty recognizes Japan's right of self-defense, as well as her right to enter into collective security arrangements. On the same day that the treaty was signed, Sept. 8, 1951,

Japan and the United States signed a security treaty. On March 8, 1954, the United States and Japan signed a mutual defense assistance agreement. Three months later, on June 2, the Diet passed bills creating, as of July 1, a new army, navy, and air force. See also section on *Occupation and Foreign Relations (1945-1954)*.

Social Security and Welfare.—The traditional family system, which placed the burden of social and economic welfare of its members on the family, stifled, if it did not prevent, the development of the responsibilities and functions of the state in social security and welfare. As a result, social welfare had come to be regarded as the special province of private charity. The system of social security and welfare provided by the Constitution of 1947, however, guarantees the people "the right to maintain the minimum standard of wholesome and cultural living" by "the promotion and extension of social welfare and security and of public health." Necessary legislation and the organizational framework have been provided to carry out an integrated and coordinated program of public health, public welfare, and social security. An entirely new concept was introduced not only in social welfare, but in civic responsibility as well, when the first community chest campaign was conducted with marked success throughout the nation in the fall of 1947.

Public assistance is now available to those involuntarily in need. Unemployment insurance, health insurance, and welfare annuity insurance help to offset insecurity, while child welfare legislation gives protection to children. The National Disaster Law enacted in October 1947 places the financial responsibility for the relief work necessary in times of natural disaster on both the prefectural and the national governments. Great progress has been achieved in the field of public health, which had lagged far behind the systems of the progressive nations of the West. A systematic and effective program of public education, together with the reorganization of medical education and health facilities, has been instituted. Programs instituted under SCAP supervision for the control of communicable diseases were so successful that the overall death rate for 1948 showed a 53 per cent drop over that of 1945.

Political Parties.—Revival of political parties followed the surrender of Japan by a few weeks. The SCAP directive of Oct. 4, 1945, abrogating and suspending all laws, orders, and regulations restricting freedom of thought, religion, assembly, association, speech, and the press, was the signal for the resumption of political activities, which had been virtually banned during the war. First to reappear was the Social Democratic Party, which was formed on November 2; it was followed by the Communist Party and the Liberal Party within a week, the Progressive Party in mid-November, and the Peoples' Cooperative Party in late December.

The labels of the new parties were of little value in identifying them. These parties actually constituted a revival of old political forces, alignments, and personalities. To be sure, they emerged in seemingly new garb, but old political ties and personal relationships were unmistakably there. The Liberal Party showed a number of familiar faces from the Seiyukai; the Progressive Party drew its membership largely from the Minseitō and the Seiyukai. The Social Democratic Party included the Socialists from

the old Social Mass Party and other groups ranging from the extreme Left to the extreme Right. Somewhat new in appearance was the Peoples' Cooperative Party, drawing conservative support from middle- and small-scale business and industrial elements as well as from the landowners. Its goal has been a working compromise through cooperation between capitalism and socialism. The Japanese Communist Party has been by far the most vociferous and militant political party. It is the only party which derives its policies, inspiration, and support from external, non-Japanese sources and employs tactics abhorrent to the majority of the electorate. However, in the general election of January 1949, it won 35 seats in the House of Representatives by polling close to 3,000,000 votes and also succeeded in placing six members in the House of Councilors. After reaching its peak of power in late 1948 and early 1949, the Communist Party began to show signs of decline largely through the alienation of voters, the public, and even the labor unions. In 1954, however, it still remained a force to be reckoned with, especially since it could become an effective fifth column for the cause of communism.

Postwar governments have all been formed through coalitions of some kind, involving all sorts of political deals. The possible exceptions—if they were really such—were the third and fourth governments of Prime Minister Shigeru Yoshida, which were formed in 1949 and 1952, respectively.

As in the past, political parties are still plagued by internal disunion, resulting in splitting and fragmentation. These parties all suffer in various degrees from inexperience and lack of proper leadership as well as of new blood. Old party men accustomed to old ways of thinking and doing things and bureaucratically trained men with bureaucratic ideas, attitudes, and techniques of handling men and problems occupy positions of party leadership. Political deals are still consummated behind the scenes in the customary manner. Corruption has not disappeared, nor has bossism been removed from every level of politics. Naturally public distrust of political parties is still strong. Political parties which still lack a popular base concern themselves primarily, though not exclusively, with a relentless pursuit for power, constantly maneuvering to gain control of the government. Personalities more than principles influence their decisions and actions. Parties and their leaders must demonstrate their firm grasp of the meaning of democracy, not merely in the abstract but as an attitude of mind as well as a process in the context of Japanese politics, if they are to become an effective force in building a democratic system of government.

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12. CHANGING CULTURAL PATTERNS. The broad outlines of Japanese society, as described in the section on *The People*,

have persisted for centuries. The rapid changes since the 1930's, however, invite more detailed description, both of persisting features and of innovations.

Homogeneity.—The striking cultural homogeneity of the Japanese people is no innovation enforced by an adventitious dictator. The stern sumptuary laws of the Tokugawa period (1603–1867) laid the basis of a conformity that still persists. By the 17th century samurai were authorized to behead any civilian whose conduct was “other than expected,” and until 1945 police supervision continued to ensure high uniformity in conduct. Japan's geographical insularity has been abetted by these controls, by a written language that minimizes international communication, and by indoctrination in the public schools. Despite obvious individual differences, every Japanese has resembled every other Japanese much more closely than American or European individuals have resembled their compatriots. Although the stress on democracy after World War II fostered individual differences, Japan's population continues to be less diversified than Occidental populations.

Superficially the smooth channels of etiquette and custom have confined behavior within accepted limits, but the consequent efforts to ensure that everyone conforms to expected conduct have betrayed deep insecurities in personal relations. The pressure to conform has appeared in numberless small items of behavior; common folk formerly bowed abjectly before their superiors and still do so. Even in feudal days, when oppression called forth peasant revolts, no one proposed the abolition of the upper classes, and there was general acceptance of the savage penalties visited on leaders of a revolt. After World War II the people relaxed visibly when police supervision diminished. Were this situation to continue for a generation, Japan's cultural homogeneity could give way to considerable diversity in behavior and personality.

The persisting cultural homogeneity of Japan has been evident in features that have outlived the centuries and that change in form but continue in essence. These include the idea that government is a magical ritual to ensure national welfare—an idea sorely battered by the facts of World War II and thereafter competing with the concept of government as the business of the people; high regard for learning and respect for teachers; glorification of frugality and renunciation of wealth as a criterion of status; family-like guilds of craftsmen and specialists; men's associations, often secret and sometimes actively violent in politics; subordination of females ever since the Buddhist ascendancy of the 9th and 10th centuries; stress on formal etiquette as the technique of social intercourse; emotional tautness that appears both as alertness and as hypersensitivity to insult; freedom from prudery and unemotional acceptance of nudity when dictated by convenience; cultivated aesthetic sensitivity and delicately disciplined manual dexterity; adoration of the scenic beauty of “the land of the gods”; distaste for animal husbandry; seasonal festivals that regulate the peasant's calendar, perpetuate ritual, and afford recreation; houses built on posts with clear space beneath the floor, paper-covered doors, and a place of honor in a guest room; exaltation of the warrior as the social cynosure, and reckless devotion in battle to the overlord—a tradition vociferously

repudiated since World War II; and profound insecurity when confronted by situations not provided for by rule and custom—a corollary to the stress on conformity.

The conservatism inherent in the family organization has preserved these and many other time-honored cultural traits. Although the family organization and its attendant customs have decayed rapidly since the United States occupation, it is too soon to conclude that this trend is irreversible. A characteristic aspect of Japanese cultural homogeneity has been the unanimous and rapid swings of fashion and of political and general opinion from one extreme to another, and this trait may easily reverse many current trends.

Cultural Receptivity.—In contrast with the urge toward conformity, and often in sharp conflict with it, established tradition assumes that desirable ideas and contrivances may be obtained from abroad. Eager borrowing of Chinese cultural patterns from the 7th to the 10th centuries foreshadowed the intensive quest for Euro-American learning and technology in the 19th and 20th centuries. Such avid pursuit of alien culture is unique in history. Wholesale adoption of foreign practices often engenders feelings of inferiority, however, and repeatedly the Japanese have overcompensated for these feelings by feverish attempts to “improve” borrowed ideas and devices and by recurrent waves of hatred of foreigners. Nevertheless, the tradition of selective adoption of exotic ideas has constituted Japan's major cultural asset. It effected a remarkable flowering of civilization that transformed a minor cultural satellite of China into a progressive nation that barely missed the hegemony of Asia.

The traditional openness toward foreign institutions facilitated acceptance of numerous reforms introduced by the postwar occupation, but the usual reaction against an overdose of new practices was gaining headway in the 1950's. The same cultural receptivity also favored rapid expansion of communism; in Japanese eyes, any foreign ideology deserves investigation, even though a period of trial may lead to vigorous repudiation. Both American democratic practices and Communist-Marxist ideology are candidates for this mass acceptance and subsequent rejection. Ultimately such ideological turmoil results in assimilation of some of the foreign ideas and techniques, and Japanese culture manages to preserve its distinctive aspect.

The occupation was unique in Japan's history—not primarily for its military implications, but because it brought large numbers of Japanese into personal contact with foreigners. The social and cultural consequences of this contact are not readily ascertainable as yet, but certain apparently minor cultural innovations, such as the relaxation of formality in social contacts and the establishment of new forms of recreation, may outlast the formal institutional changes that were supported by military fiat.

Simultaneously, the Communists demonstrated that Japanese could challenge the sanctity of their emperor. In practical consequences, this breach with the past may outweigh the military defeat that made it possible. The Communists have busily fomented anti-Americanism, and the effect on cultural innovations attributed to the United States is unpredictable. One clear effect of the war and of Japanese cultural recep-

tivity is the enhanced prestige of American technology and standards of living.

The Family as Model.—The traditional pattern of family organization reappears in larger associations and in the nation itself. Pertinent aspects of family custom include the orientation of loyalty upward toward seniors, parents, and ancestors rather than toward spouses, juniors, or collateral relatives. Transmission of lineage from eldest son to eldest son enhances the status of the first-born male and depreciates that of junior siblings and females. By law and custom ties of descent outweigh the bonds of matrimony. Formerly marriage contracts were entered into by the house, not by individuals, and a son's wife was called the bride of the house. Younger sons normally have left the house to seek independent careers. In theory they still support the house financially and submit to the family council, and in illness or hardship they may receive succor. This displacement of junior sons—and, in modern times, of unwed daughters—combined with the transfer of married daughters to other households, underlies many unique aspects of Japanese society.

Family interests appear also in the pervasive etiquette of face—that is, protection of family status and dignity against a hostile world. Although emphasis on face has declined, especially in the rearing of children, a child still knows that his misconduct may lose face for the house. Before World War II scarcely a year passed without newspaper reports of suicide by a small child after a reprimand at school. Teachers often said that it was better to promote all pupils in a class than to risk face for some family. Etiquette supports polite fictions (*yūmei mujitsu*) that protect families from public exposure of their weaknesses.

In feudal times social organization was patterned strictly after the extended family. Even in the modern period it has been customary for travelers who hail from one's ancestral *kuni* or ancient province to expect and receive the hospitality accorded to relatives. Political alliances and rivalries often have stemmed from loyalty to the old-time *kuni*. Organs of local government, committees, industrial combines, professional associations, and, in theory, the nation acknowledge the familial pattern of human organization and determine their policies much as family councils arrive at decisions.

Typical of the infusion of family concepts throughout Japanese social organization is the institution called *oyabun-kobun*. This is a ritual pseudo kinship that appears in labor groups, craft associations, political parties, professions, and racketeering. An occupational or other group centering in a vested interest sanctioned by custom often assumes the form of an extended family. Members, not blood kin, nevertheless assume ties that bear kinship designations, and within the framework of the association treat each other as kindred. The head of the organization is addressed as *oyabun*; *oya* means "parent," and the suffix *-bun* (sometimes *-kata*) distinguishes these terms of pseudo kinship from the otherwise identical terms of family affiliation. Protégés and subordinate members of the pseudo kindred are addressed as *kobun*; *ko* means "child." There may be a ritual grandfather, uncles, elder and younger brothers, and grandchildren—all addressing each other by the appropriate kinship terms carrying the suffix *-bun*.

The initial organization of an *oyabun-kobun* group includes a ceremony in which the members pledge filial and fraternal loyalty by drinking sake to which salt and a bit of fish have been added to symbolize blood. Usually the group assumes a "family" name, and *kobun* may wear jackets bearing this ritual name. The *oyabun* obligates himself to aid his *kobun* in obtaining vocational training and in finding employment, and provides loans when needed and care in illness. In turn, the *kobun* are expected to aid the *oyabun* in retirement and to provide for his funeral.

Family solidarity and social stability formerly centered in the ownership of real estate and other property by the house; the current head served as a sort of trustee. Normally he retired sometime after reaching the age of 50 in favor of his eldest son or heir. A last will and testament was superfluous, and the death of a retired head rarely occasioned redistribution of property. If the heir was a minor, the family council appointed an acting head. Consequently, testamentary problems received slight attention in Japanese law; the durable issues centered in problems of inclusion in, or exclusion from, membership in a house, and in succession.

All this was upset by new inheritance laws promoted by the postwar occupation. American concepts of individual ownership and disposal of property by a will were embodied in laws working to disrupt the traditional family organization. Brothers and sisters now inherited equally, and family property thus became subject to dispersal whenever the head of a family died. In litigation the emphasis shifted to problems of inheritance and allotment of individual shares in property formerly held by a family. If these laws continued in force, radical changes in the family system would be inevitable, and Japanese social organization might adopt new patterns and shift away from the *oyabun-kobun* model.

Country and City.—In the 20th century divergence of urban and rural populations has threatened the homogeneity of Japanese society. In earlier times Japan was notable for its simple feudal dichotomy of helpless peasants and military overlords. As elsewhere in southern and eastern Asia, the peasant who raised wet rice was tied to his paddy and hamlet. He lacked the means of broadening his horizon and resignedly accepted the inscrutable vagaries of flood, drought, typhoon, earthquake, civil war, and government. Over tangible issues such as land rent and water rights he flared into violence, but the hills that furnished his precious water circumscribed his imagination.

Urban life, however, was no novelty in Japan. There have been cities for a dozen centuries. Their luxuries were formerly obtained at the peasant's expense, but modern industrial urbanization has achieved a measure of independence from the local agrarian economy. In the late 1930's frenzied preparations for war accelerated the concentration of industry, and the cities grew explosively. From the 1880's to the 1930's the rural-farm population continued stable at 35 to 40 millions, the farms were saturated, and the population increase was accommodated in the cities. World War II drove many city dwellers back to the farms, however, while other urbanites moved to suburban fringes away from the bombed-out centers and thereby seriously reduced the effective area of cropland.

Meanwhile, a startling agricultural revolution, based on the intensive education of farmers in scientific agriculture, gained momentum beginning in the late 1920's. Scientific techniques thus diffused among farmers include precise knowledge of fertilizers—animal, chemical, and vegetable; knowledge of the uses of hybrid seeds; pest control; minute attention to soil chemistry; control of plant diseases; and ingenious mechanization of many farm operations. Threshing, formerly done by flails, is performed by foot-power machines of Japanese invention; the laborious hand manufacture of the indispensable straw rope has been replaced by a footpower machine that turns out better rope in a fraction of the former time; and rice is ground or hulled in power mills. Electricity has become available in most rural districts, and many farmers own small internal combustion power units. Since the mid-1930's increased productivity of cropland has permitted farm population to increase, even as rural standards of living have risen. Land tenure reforms initiated by the occupation, abetted by inflation and black markets for farm produce, have cut sharply into farm tenancy and farmers' debts.

Consequently, by the mid-1950's the farmers in many parts of Japan had begun to approach urban standards of living. Their diets had expanded to include canned foods, bread, candy, and other luxuries. Universal schooling had equipped farm people to acquire scientific knowledge, to read newspapers and magazines, and to take advantage of the general availability of radio sets to keep in touch with the outer world—especially to keep posted on markets. Small factories close to farm villages offered part-time employment to members of rural households and provided many families with cash.

Since urban populations have been recruited from junior sons and daughters whom rural homes could not accommodate, the cities include millions of individuals whose old family ties are tenuous and whose outlook is congenial to innovation. Urban workers, however, often maintain one tie to their rural kindred: during the economic stringency of the 1930's unemployed workers returned to the ancestral villages to share the meager fare of their country cousins. Similarly, during World War II urban refugees dispersed to live with rural kinsmen until cities once more became habitable. Such emergencies impose a heavy burden on the peasants' strained resources—a burden mitigated in postwar years by black-market prices for foodstuffs that brought cash to the farms. Given a stable economy free of depressions and wars, however, the gap between peasant and city dweller might continue to widen along lines evident before 1930.

The widespread Asian tradition that land is the safest investment persists despite the development of a capitalist economy. In an overpopulated country this kind of investment quickly forces land prices far above the level of profitable farming. Peasants fall into debt, good land is concentrated in the hands of landlords who do not understand farming, and the wastes and human misery of tenancy multiply. A further threat to Japan's rural population inheres in the failure to divide the tax load equitably between industry and agriculture. Prior to World War II, Japan's entire economy involved hidden dependence of "modernization" upon the farmers and fisherfolk. Tax-subsidized heavy industry,

plus governmental bureaucracy, plus armament costs imposed a crushing burden on the farmers. Some redistribution of the tax load occurred during the occupation, but fundamental reforms have continued to be postponed, and farmers speak of the future with deep misgivings.

City and country alike manifest certain far-reaching social changes in the status and behavior of women. The woman's movement, which had its roots in the democratic enthusiasms of the early 1920's, was carried far toward fruition by the postwar reforms of the 1940's and early 1950's. Women's societies are universal. During World War II they were drawn into the net of governmental organization in patriotic endeavor. Since the war they have followed the lines of development familiar to Americans and to many north Europeans. Women speak out in political matters as never before, and a notable increase in educational facilities for women contributes richly to the new public spirit.

The new outlook of women has been accompanied by a whole series of innovations in infant care and child-rearing practices. Improved access to physicians and the scientific training of midwives have combined with the wide reading of baby-care books to revolutionize the early months of life for millions of Japanese. As these babies mature and assume responsibility, their generation may conceivably accept goals and values that have not been congenial to their forebears. The numerous inexpensive magazines for women exert great influence, continually diffusing new methods of homemaking, cooking of novel dishes, child psychology, Occidental fashions, and diverse points of view concerning women's status, sex, politics, and the technology of domestic life.

Sheer physical changes in Japanese cities facilitate changes in living habits. Playgrounds, parks, and public recreation facilities; public water supplies, gas, electricity, and cheap rapid transportation; and, above all, the endless variety of goods on display in both old-style shops and luxurious modern department stores—all these combine to render impossible the return to ancient patterns of living. Japan's cities, prior to World War II, had approximated the appearance and the animation of Occidental cities. The devastation that razed much of their area during the war proved a boon from one point of view; it suddenly became possible to substitute wide, straight boulevards for narrow, winding streets, to make room for parks, and to improve transportation. On the whole, most cities took full advantage of these opportunities, and the new physical aspect of urban Japan carries few hints of the ancient Orient. People who ride in subways, live to the blare of radio and television, read books of every country in translation, grow up on paved streets and find their pleasure in theater, dance hall, night club, ball park, or race track can reconstitute the social forms of the past only in sentimental pretense, never in reality.

So, like all great cities, those of modern Japan provide advantages for their denizens and also expose them to specific dangers. Ancient customs lose prestige, and demagogues can sweep urban crowds into fantastic hysterias. On the other hand, the Japanese have learned that in modern war cities are fatally vulnerable, and that even in peacetime employment may be irregular and security precarious. Stable marriage and parent-child relationships are undermined by a

bewildering variety of superficial secondary contacts, with a consequent increase in divorces, suicides, and crimes. Through mass-communication media foreign customs and ideologies are adopted overnight, and are as speedily forgotten.

Ever since the opening of the 17th century, Japanese society has been tightly organized on a class pattern, and even after the restoration of 1868, four distinct classes—nobility, gentry, commoners, and 'new commoners'—were recognized and everyone had to state his class when he filled out legal documents, police records, school certificates, or similar formal papers. This simple scheme has not survived the changing needs of an increasingly industrialized, bureaucratically ruled society in an urban setting. The formal abolition of class distinctions occurred in the 1930's in the course of the egalitarian movement incidental to the prewar totalitarian, militarist enthusiasms. The obsolescence of formal social classes occurred not through democratic, but through antidemocratic, influences. Nevertheless, the success of this attempt to fit the nation into the egalitarian formula of totalitarianism was possible because economic status, skill, occupation, learning, military rank, civil service grades, and differences in income already had reduced the four-class system to a meaningless rubric. Sensitivity to differences in social status, and to the differences embodied in the obsolete class system, however, persists rather conspicuously in the social behavior of most individuals.

Etiquette and Morals.—The entrenched regard for social class attained explicit formulation in the language and etiquette of Japan, and despite a notable relaxation of the rules of etiquette and a corresponding simplification of language after World War II, the traditional patterns have not vanished. The phenomenon of a divine upper class which must be addressed in special words is found again and again in southern and eastern Asia, and perhaps the closest parallel to the traditional Japanese usages occurred in Polynesia. The Japanese language comprised several languages in one, each adapted to addressing persons of social status above or below that of the speaker.

This linguistic etiquette symbolized the entire pattern of social relations. Quite in the Confucian mood, one has needed to know one's own position in relation to the status of everyone encountered, and has governed social contacts in accordance with the rigid patterns thus indicated. Traditionally, introductions are performed only if both individuals desire to meet, and the ritual of presentation amounts to self-introduction. The nearest equivalent to the Occidental handshake is the deep bow from the hips; this gesture of courtesy upon meeting is not optional, as is the handshake, but marks every meeting, parting, or expression of courtesy.

The assumption of humility toward equals or superiors is fundamental, together with a degree of arrogance, however restrained, toward inferiors. One's own family and possessions are deprecated, while the use of honorific linguistic forms indicates the person or possessions of another. One compliments another person by calling at his home, but in the mood of humility refrains from inviting others to one's "mean abode."

In the mood of the basic Confucian relationships, most Japanese are involved in complex patron-protégé situations. In social or business

contacts one normally relies on a guarantor (*hoshōnin*) who prepares introductions and negotiations in advance and mediates divers transactions. For example, in filling an important post an employer deals with a trusted acquaintance who proposes and vouches for a prospective employee. The latter would not dream of any breach of trust that would lose face for his sponsor.

Etiquette merges indistinguishably with moral standards. It was taught of old—and indeed until 1945—that the ordinary Japanese owed his very existence to ineffably glorious, supernaturally endowed overlords, even as he owed his bodily form to his parents. Thus he was born under obligations that could be acknowledged but never could be repaid. One receives *on*—the beneficence of emperor, parent, overlord, teacher, or patron—and owes *gimu*, an obligation or liability that under the old code must be kept constantly in mind. It was taught that the *gimu* of loyalty due the emperor could not be repaid, not a ten-thousandth part of it, even by death in battle. *Giri*, on the other hand, denotes the obligations that one incurs and repays in the normal reciprocities of living. *Giri* is the sense of propriety that prompts one to offer a return gift, to work for a neighbor who has rendered assistance, to avenge an insult, or to perform duties to relatives. Maintenance of face depends on sensitive awareness of *on*, *gimu*, and *giri*; the comment *giri wo shiranu* (he does not know *giri*) may imply moral deficiency as well as ignorance of manners. Benefaction, loyalty, reciprocity, duty—a household is judged and accorded neighborhood status in these terms. But the old traditions lose force in the cities, and many young people ignore them.

Integral in the patterns of etiquette and morals are aesthetic ideals such as the goal of sophisticated simplicity in the arts. The relative absence of furniture in a typical Japanese home exemplifies this ideal. A guest kneels on the thick straw floor mats and sits back on his crossed feet; politely he defers acceptance of a proffered cushion and resists the host's urging to move toward the place of honor. Meals are served with due regard to aesthetics; the little dining tables are about a foot high, while the lacquered bowls and porcelain dishes are arranged tastefully on lacquered trays to display the colors and textures of the foods. Rooms are not adorned with pictures or bric-a-brac; usually a single long scroll painting graces the place of honor, and this probably has been changed just before the arrival of an expected guest. If the guest is skilled in the social graces, he will notice the picture, interpret the literary or other symbolic allusion, and thereby compliment his host. Such complex rituals of etiquette as the famed tea ceremony are charged with moral, aesthetic, and religious significance. On the whole, the urban younger generation exhibits considerable ignorance respecting traditional etiquette, aesthetics, rituals, and folklore.

Obsolescence of Handicrafts.—The displacement of handicraft production by factory-centered technology, well under way in the 1920's, was accelerated tremendously by World War II. Formerly every locality proudly displayed and sold its *meibutsu* or local product, and most goods used domestically came from handicraft technology. Many craftsmen were organized into guilds that maintained unity by rituals and rules enforced on members. Quite generally the technique of production was dramatized and kept uni-

form by chanted rituals that sometimes required the specialized knowledge of a Shintō ritualist. The war changed all this. Craftsmen were drafted into factories in which their special skills supposedly would count, tools were remelted, and other equipment was dismantled. Very few of the traditional handicrafts remained by the 1950's.

Recreation.—The idea of regular vacation periods was adopted into Japanese culture from Euro-American sources in the 1920's. Previously rest days had been limited to the 15th and final days of each month, to seasonal festivals like the cherry-blossom holidays in spring, the New Year, and celebrations at shrines and temples. Pilgrimages, nominally religious, were prolonged picnics at holy places, shrines, and spots renowned for natural beauty. Recognized vacation areas other than hot springs came into vogue in the 20th century, and national parks were established after 1930.

The ancient nobles enjoyed trials of skill such as archery, a form of football, and military exercises, as well as aesthetic rituals like the tea ceremony and incense-smelling contests. Modern popular sports incline to mass spectatorship at baseball games, all sorts of track races, *sumō* (a kind of wrestling between specially nurtured giants), sword or fencing practice called *kendō*, and *jūdō* or *jūjitsu*. *Kendō* and *jūdō* differ in psychology from Occidental sports; their exponents regard them as preparation for deadly combat without quarter. Prior to and during World War II all Occidental sports were discouraged, and some of them prohibited, on the ground that they did not prepare men for victory in combat. Since the war all of the banned sports have been resumed enthusiastically.

Many Japanese devote time to a decorative garden, the care of dwarf trees, and the making of tray gardens, or to more active pastimes such as hiking and mountain climbing. Women practice flower arrangement. Such activities include religious and aesthetic values in addition to recreational aspects. Calligraphy, the composition of tiny poems, the mastery of an ancient dance or song, and the practice of a skilled craft combine hobby, recreation, and art in a uniquely Japanese fashion. Among hobbies borrowed from the Occident, photography probably occupies first place; ham radio, philately, numismatics, and the collection of books, antiques, and phonograph records all claim devotees.

Japan's assimilation of Occidental music constitutes a striking cultural transformation, for Occidental music and Japan's traditional music are almost totally incommensurable. The ancient types of music survive, but much folk music follows Western patterns. The people sing folk songs of every nation, dance tunes, opera arias, and the latest jazz. When a symphony concert is broadcast, it is an unusual group of listeners that does not include someone who can identify Occidental works by name and composer.

The cinema appeared in Japan almost as soon as it spread in the Occident. Foreign films are popular, and Japanese producers turn out films that win audiences abroad despite the handicap of language.

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13. RELIGION. Religion in Japan today means primarily the three recognized religions—Shintō, Buddhism, and Christianity. Prior to about 1900, Confucianism was the third religion, instead of Christianity. The role these religions have played in the life of the Japanese is seen best when presented historically. Japan's religious history may be divided into seven periods:

(1) Prehistoric and semihistoric, ending in the 6th century A.D.

(2) Early Buddhist, 6th to 8th century, in which Buddhism was introduced and was accepted primarily as the vehicle of the higher Chinese civilization.

(3) Heian Buddhist, 9th to 12th century, when Buddhism, together with other elements of Chinese civilization, became an integral part of the religious and cultural life of the upper classes, while Shintō remained predominantly the religion of the masses.

(4) Indigenous Buddhist, 12th to 16th century, when Buddhism with marked changes became the dominant religion of all classes.

(5) Period of the regimentation of all life, including religion, in the interest of a police state, 16th century to 1868. Buddhism remained the dominant religion but lost ground to neo-Confucianism and reascent Shintō. Christianity flourished for a short time, only to be rigorously suppressed.

(6) Period in which religion was an instrument of an expanding state (1868-1945). Shintō, Buddhism, and Christianity were regarded in varying ways as of possible service to the state but were circumscribed in their activities, while State Shintō was sponsored as a cult of patriotism superior to all religion.

(7) Post-World War II.

Prehistoric and Semihistoric Period.—The religion of the early Japanese was primarily a naive nature worship to which was added, possibly under Chinese influence, a form of ancestor worship. The objects worshiped were designated by the term *kami*, meaning "above" or "superior." Any object or natural phenomenon giving rise to a feeling of wonder, awe, or fear was regarded as a *kami*. The most widely worshiped *kami* were the sun, moon, mountain peaks, streams, waterfalls, and devastating storms, but innumerable other objects such as large trees, stones of peculiar shape, certain animals, and even insects were worshiped.

The *kami* concept naturally underwent some changes in meaning as the Japanese gradually emerged from their primitive state. We can distinguish roughly three levels in this early period. There is first the preanimistic conception by which the natural object or phenomenon is worshipped as such without the worshiper formulating

any definite idea about it. This holds true especially for such awe-inspiring objects as the sun, majestic mountain peaks, or the terrible storms. The second level is typical animism, in which certain objects or natural phenomena are seen as controlled by some indwelling spirit, good or evil, which must be worshipped or propitiated. On the third level the innumerable nature spirits are made over more and more into the image of man himself, and thus we get the familiar gods and goddesses of polytheistic Shintō with its growing mythology. On this third level of Japan's early religion appears a form of ancestor worship—that is, the dedication of clan chieftains, heroic warriors, benefactors, and ancestors. The two lines—the nature spirits and the deified humans—were then more or less merged, and we see the picture of early Shintō's *yao-yorozu-no-kami* (800 myriads of gods).

This development of the *kami* concept took place apparently before the early Japanese came consciously under the influence of the more mature religions of China. Japan's oldest literary records, the *Kojiki* (712 A.D.) and *Nihon Shoki* (720), reflect this type of religion. At the same time, however, they show how the unorganized and primitive nature and ancestor worship was being more or less organized into a system called Shintō, a Chinese term meaning "way of the gods." In these records we find a crude theogony and cosmology. There are two major groupings of deities: the seven generations of celestial deities, and the subsequent terrestrial deities. Prominent in the first group are deities representing creative or productive powers such as the high-producing or the divine-producing deity. The last pair of the celestial deities, Izanagi and Izanami, produce the Japanese archipelago and various lesser objects of nature. Izanagi alone begets Amaterasu-ōmikami, the Heaven-Shining Great Deity, and Susa-no-wo, the Swift-Impetuous Deity, or Storm God, the former standing increasingly for enlightenment and all that is good, and the latter for the forces of violence and evil. This nascent dualism was never developed, probably because of the overpowering influences of Chinese civilization in the subsequent period.

The Sun Goddess, Amaterasu, originally a major nature deity worshiped by all the clans, was recast at the dawn of history as the divine progenitor of the ruling family. Each clan had its own clan deity, *uji-gami* with the clan chieftain, *uji-no-gami*, serving as high priest, and, as such, regarded as semidivine.

The shrines of early Japanese religion were at first objects and places which called forth a feeling of awe and wonder. Then, simple structures of wood or stone were erected to house the object in which the spirit was believed to dwell. Such objects were called *shintai* (god body). The most famous of them were the three insignia of imperial authority: the sacred mirror, the curved jewel, and the sword.

The good-life ideal was conceived largely in terms of the physical. The gods received in sacrifice the kind of things the pious devotee expected of them in return. Ethical and spiritual elements were present only in a rudimentary form. There is also very little regarding man's ultimate destiny. The early records speak of a realm of gloom, and the gods are pictured as descending from the heavenly realm, but there is little in the way of giving man hope in a life after death. Possibly, however, there was more

than appears in the records, and it was forgotten as the early Japanese turned to Buddhist teachings about the individual's destiny.

Early Buddhist Period (6th to 8th Century).—Buddhism reached Japan first by way of Korea in 552 A.D. To gain help against his rivals, the king of Paekche sent to the Japanese court a mission which included Buddhist monks. Among the gifts they brought were Buddhist scriptures, a Buddhist statue, and various ceremonial objects. An accompanying letter recommended Buddhism as "the most excellent of all teachings," and explained that it was generally accepted in all countries from Korea to India.

A great controversy soon developed, some Japanese advocating acceptance of the new religion, while others bitterly opposed it. Within a few decades, however, Buddhism gained a real foothold, and when the prince regent, the famous Shōtoku Taishi (r. 593–621/622) began sponsoring the new faith its future was assured. In an edict he urged his people to "sincerely reverence the Three Treasures (Buddha, the doctrine, and the order)," for these "are the refuge of the four classes of living things and are in all countries the supreme object of faith." In thus sponsoring Buddhism, Shōtoku Taishi set an example which subsequent Japanese sovereigns usually followed. The prince himself was well versed in Buddhist lore and gave lectures on certain Buddhist texts. Of greater consequence, however, was his establishment of direct connection with T'ang China in order to learn more about the new religion and the higher Chinese civilization. In fact, Buddhism gained its first ascendancy in Japanese life because of what it brought in its train as the vehicle of Chinese civilization. Buddhist monks transmitted in ever-increasing volume much of Chinese literature, art, architecture, medical lore, and various crafts. Great temples, monasteries, hospitals, and asylums were established. The Buddhist ideal of the unity of all life was a factor in the Taikwa (Great Reform) of 646 which reshaped Japan's political structure on the Chinese administrative pattern. Even those loyal to the native faith showed the influence of Buddhism in their organization of the innumerable local cults into a sort of system, with the Sun Goddess given greater prominence as the divine ancestress of the ruling family. The naive legends and mythologies were arranged into a kind of history by following the Chinese model.

The influence of Buddhism is perhaps best seen in connection with Japan's first real capital city, Nara, which was patterned after the Chinese capital, Changan. With its great temples and monasteries it grew into a city of real magnificence. The gigantic bronze statue dedicated to the Buddha Vairocana (Vairocana), known in Japanese as Dainichi (Great Illuminator) and declared to be one with the Sun Goddess, prepared the way for reconciling the claims of the two religions. To be sure, the vast majority of the people continued to worship their local Shintō deities, but many, especially in the capital and in some of the provincial centers where Buddhist temples were being built, came increasingly under the sway of Buddhist teachings.

Six different schools of Chinese Buddhism found their way into Japan during this period. In varying ways they accustomed the Japanese to think in terms of universal concepts. The Buddhist conception of the divine, of man as a citizen of eternity, the ministry of mercy as ex-

pressed in the Bodhisattva ideal, and the general ethical teachings of Buddhism were all of them far more satisfying than what the old faith had to say on such matters.

Heian Buddhism (800-1200).—The removal of the capital in 794 to Heian, later called Kyoto, marked a change in the religious situation. The very word *heian*, which means "peace and tranquility," expresses the Buddhist ideal of life. Whereas in the preceding period Buddhism had been propagated largely by foreign missionaries, now the work was done almost wholly by Japanese who had studied at Buddhist centers in China or at great centers of Japanese Buddhism as these developed, especially at the Tendai establishment on Hieiizan, near Kyoto. Two monks in particular helped to usher in this new period: Saichō (767-822), better known by his posthumous name of Dengyō Daishi; and Kūkai (774-835), the famous Kōbō Daishi. In 804 they had as young monks accompanied a government mission to China, and after a few years' study on the mainland, they returned to Japan bringing with them new forms of Buddhism.

Dengyō Daishi studied at the great center of T'ien-t'ai Buddhism, a type most comprehensive in its teachings, and he founded in Japan the Tendai sect, which subsequently played an important role both as one of the two major sects during this period, and later as the source of new sects. Dengyō was faithful in transmitting to Japan the all-inclusive Tendai type of Buddhism, which tries to find room for all the varied teachings of the voluminous Buddhist canon. Nevertheless, he felt that the great essentials of faith were best formulated in the famous Lotus Sutra (*Saddharmapundarikasūtra*; in Japanese, *Myōhōrengekyō*), which glorifies the historic Buddha Śākyamuni as the eternal Buddha. In this view, although the eternal Buddha as absolute being transcends man's comprehension, for practical purposes a religious man may think of Buddha in terms of ideal personality. The eternal reveals itself on different levels and thus fills the needs of finite man. This conception made room for whatever truth there was in other religions, even for the crudities of Shintō. In Dengyō's Buddhism there is also a place for different ways by which man can be saved—the hard way of moral discipline, in which man works out his own salvation; the way of philosophic insight into the truth; and the way of faith and simple trust in the mercy and grace of the eternal Buddha.

Kōbō Daishi, trained for an official career, had studied Confucianism. He also investigated Taoism, but was finally converted to Buddhism. Truth was to him a matter of varying degrees and so he arranged what he had found in his studies in an ascending scale with Buddhism at the top, and with a particular form of Buddhism found in the Chinese Chên-yen school as the most excellent of all. This type he introduced into Japan under the name of Shingon (true word) or Himitsukyō (secret teaching). Kōbō, like Dengyō, had much to say about the eternal Buddha, especially Dainichi Nyorai, the Great Illuminator, but less about the divine as personal. According to Shingon, Dainichi Nyorai is the central sun from which all truth radiates. The many rays are the fragmentary truths seen by different finite minds. Just as these rays radiate in various and even opposite directions, so man's half truths and even contradictory views may each have its place and meaning. Not only is there room for

the wide variety of partial truths found in Buddhism, but also for the naive views of Shintō. It was Kōbō's system which more than any other supported that syncretism of the two faiths which prevailed down to modern times.

The eternal Buddha is also represented as the source from which all things emanate so that "in every particle of dust" may be found the nature of Buddha. How much more, then, is man in his inmost nature an offspring of the eternal. He therefore can become one again with the eternal in spite of all his frailties and evil. Sometimes this view of man's nature and his possible destiny found worthy expressions in Kōbō's system, but frequently there is reflected too much of the degenerate type of Indian Tantric Buddhism which makes room in religion for anything man desires. Very little of the moral seriousness of original Buddhism remains and Shingon (true word) becomes the "magic word" which combines a fantastic idealism with the grossest form of materialism.

In one form or another, Buddhism became dominant in the life of the upper classes. Japanese sovereigns continued to support the imported faith, and some of them became monks themselves upon abdicating, taking the title Hō-Ō, or king of the law (of Buddha). Such abdications were often forced, but nevertheless the step taken was represented as honorable. The elaborate Buddhist ceremonials invaded the court ceremonies and added to their splendor, and Kyoto became a city of great magnificence with numerous temples and religious institutions, many of them examples of the best in architecture and filled with fine paintings and sculpture. Serious literature was almost wholly Buddhist, and even such as dealt with secular subjects reflected the Buddhist view of life. In spite of this outward splendor, however, the inner life was not correspondingly rich. In fact, there was often an emptiness stemming from an awareness of the fleeting character of all earthly things, without the real assurance that mortal man could become a citizen of eternity, a conception which Buddhism was supposed to stress. Moreover, the all too facile compromises with Shintō and the religion of the masses left many Buddhists religiously illiterate.

There were, nevertheless, minor movements preparing the way for a type of Buddhism which had real vitality and meaning for the common man. This was especially true of the *Ōjōyōshū* (*Essays on Birth into Paradise*) of Genshin (Eshin, 942-1017), and the preaching of a few others about the eternal Buddha Amida and the way of salvation through faith in his mercy and grace. This teaching was not wholly unknown in Tendai Buddhism, but Genshin lifted it above the many other teachings and gave it prominence. Its real significance appeared with the rise of the great Amida sects in the following period.

Indigenous Buddhism (1200-1600).—The tremendous changes in the political life of Japan during the latter half of the 12th century affected the religious situation and opened the way for new and more popular forms of Buddhism. Three new types developed and became more or less dominant throughout the land.

First in time and in its continuing influence is Amida Buddhism with its two major sects, Jōdoshu and Jōdo Shinshu, founded respectively by Genkū, known as Hōnen Shōnin (1133-1212), in 1175, and Shinran (1173-1262), in 1224. Hōnen had been a studious monk of the Tendai

sect, poring over the voluminous canonical scriptures without finding actual peace of mind until he read Genshin's *Ōjōyōshū*. Then he saw that the heart of Buddhism was the prayer *Namu Amida Butsu* ("I worship thee, Amida Buddha"). "When we invoke Buddha and say '*Namu Amida Butsu*' with the firm belief that we shall be born in Buddha's paradise, we shall surely be born there." To his friends, who were perplexed by a profound scholar's giving such a simple interpretation of the essentials of Buddhism, he replied that if he knew anything more profound and withheld it from others he would be forsaken by the "two lords"—the eternal Buddha Amida and the historic Buddha Sākyamuni, regarded as the one who taught about Amida.

Hōnen's simple gospel was heard with joy by all classes of society. Court circles and upper classes whose world was crashing with the decline of imperial power found hope in his message. Military classes, sickened by the horrors of civil war, longed for the peace of Amida's paradise. The common people, so little touched by the older forms of Buddhism, felt that this was a message for them.

Among Hōnen's numerous disciples was Shinran, who, with all his admiration for his teacher, felt that there was still too much emphasis on the old "save thyself" doctrine in the endless repetition of Hōnen's simple prayer. He also felt that religion should be less confined to temples or monasteries, and instead should express itself in the normal life of man. In place of celibacy and the ideal of the monk, he advocated marriage and family life. Thus Buddhism, which had usually been otherworldly in emphasis, became in Shinran's 13th century Japan a religion for citizens of both this and the next world. Although Shinran and his followers were accused of making salvation a bit too easy and the religious life altogether too normal, his Buddhism not only won a great following in his day, but has held its own and still shows great vitality.

Differing greatly from Amida Buddhism is Zen Buddhism, introduced from China by two Japanese monks who had studied at Chinese centers of the Ch'an sect. In 1191 Eisai (1141-1215) introduced the Rinzai sect, and about 1244 Dōgen (1200-1253) introduced the Sōtō sect, of Zen. Zen (Sanskrit *dhyāna*) means "meditation," and it is through deep meditation that man is to realize his essential identity with ultimate reality. The multiplicity of the phenomenal world with all its distracting details, when illumined by the light of the eternal, takes on new meaning. What man obtains through an intuitive insight into truth and the real nature of things cannot be expressed in intellectual concepts, for the deepest truth is "the white silence of truth." Where Eisai stressed the mystical experience and intuitive insight into inner reality, Dōgen placed greater emphasis on what is ordinarily regarded as practical and made more room for thought. Both types of Zen appealed peculiarly to the soldier class, probably because they found in Zen primarily a method of self-discipline and self-assurance, so important in meeting fearlessly the vicissitudes of the battlefield. The characteristics of Zen discipline are the quiet retreat, proper bodily posture, correct breathing, concentration of thought on a given problem expressed often in paradoxes, the intuitive grasp of the truth, momentary ecstasy, and the sense of oneness with the ultimately real.

The third type of Buddhism appearing in 13th

century Japan was the Nichiren sect, taking its name from its founder Nichiren (1222-1282). Nichiren had been a monk of the Tendai sect, and he felt that it was time to protest against the Amida and Zen teachings. He sought to restore the pure teachings of Dengyō Daishi, based on the great Lotus Sutra. Japan was then threatened by the Mongols and to meet this danger the country must be united in religion. Unity in religion to him meant loyalty to the historic Buddha glorified as the eternal Buddha in the Lotus Sutra. This loyalty was being undermined, he insisted, by the new sects which talked so much about Amida Buddha and by the vagaries of Zen mysticism. Thus, in Nichiren Buddhism religion and loyalty to one's country had become one. This is a major reason why it made its appeal to Japanese. Nichiren's belligerent spirit, which brought him into conflict with the authorities, seemed contrary to the spirit of true Buddhism which he claimed to champion. And certainly many of his fanatical followers, with their blind worship of the Lotus Sutra while ignorant of its content can hardly be regarded as true representatives of traditional Buddhism, which has usually stressed enlightenment and intellectual tolerance.

All three types of Buddhism flourished during this period. Amida Buddhism with its heavenly paradise presented its message through art and a literature that made its appeal to all classes. The gigantic bronze statue dedicated to Amida at Kamakura about 1252 was a vivid reminder of the Buddhist ideal of calm and eternal peace. This message became all the more meaningful during the incessant civil wars which lasted from about 1330 to 1600. Zen Buddhism likewise won a great following both for its spiritual discipline and essential message and for other aspects of Chinese civilization which it introduced. Sung painting, landscape gardening, flower arrangement, and the tea ceremony, all became truly Japanese. Nichiren Buddhism won many adherents by its very intensity of spirit and also because of its identification of religion with the spirit of loyalty to one's country. One major reason why Buddhism in its various forms now became truly indigenous was that its message was couched in the language of the people instead of the Chinese canonical scriptures and it was made a real part of the common man's life.

In some ways Buddhism during the latter part of this period became too much like the world it was supposed to save. Some of the great temples and monasteries came to resemble feudal states, with many of the monks engaged less in spiritual warfare than in fighting with real swords in defense of their worldly possessions.

With Buddhism becoming thoroughly indigenous, men like Ichijō Kanera (1402-1481) attempted to harmonize it more completely with Shintō, even to the extent of reinterpreting the symbolism of the imperial regalia, giving these a cosmological and ethical connotation. Thus the mirror represented the sun and stood for intelligence and sagacity, the jewel symbolized the moon and the moral qualities of mercy and benevolence, and the flashing sword stood for the stars and signified strength and courage. Ancestor worship was revived and combined with Buddhist philosophical concepts. On the other hand, men like Yoshida Kanetomo (1435-1511) attempted to give the Shintō elements in the religious syncretism greater prominence. In their

Ryobu Shintō, or dual Shintō, they claimed that the Shintō deities were the originals and the Buddhas and Bodhisattvas mere pale Indian reflections of them.

At the end of this period, in 1549, Christianity was introduced with amazing success by Jesuit fathers, led by St. Francis Xavier. Some Japanese saw in it another form of the comprehensive Buddhism. Certain military leaders welcomed the foreigners because of the firearms which the European traders accompanying the missionaries introduced. Oda Nobunaga (1534–1582), the first of the great trio of military leaders who unified Japan, welcomed them for the use he could make of them. His successor, Hideyoshi Toyotomi (1536–1598) was friendly at first but later became convinced that the missionaries were the advance agents of European powers bent on conquest. He therefore adopted a policy of banishing all missionaries and suppressing their converts. Many, under cruel pressure, recanted their faith, but thousands chose martyrdom. By 1638 the last stronghold of the Christians who had risen in revolt was destroyed, and what remained of Christianity was driven underground.

Regimentation of Life and Religion (1600–1868).—With the subjugation of the various feudal states under the Tokugawa shogunate, Japan had peace, but it was more the peace of a police state than that of a free country. In religion the government sought to maintain the status quo. Buddhism was recognized as the dominant religion and was allowed to regulate its own affairs within fixed limits and with the responsibility of keeping a strict religious census to guard against the reappearance of Christianity. The different sects worked out their dogmatic systems and published numerous works. Some monks continued teaching, but the more significant educational work was carried on by the so-called mental culture movement, which was more Confucian than Buddhist. As the guardian of man's ultimate destiny, Buddhism continued to play its accustomed role, but it was less of a factor in this worldly affairs.

The Tokugawa shogunate turned primarily to Confucianism for support in stabilizing the social structure, because central to Confucianism is the ideal of a well-regulated state whose citizens are indoctrinated with the spirit of obedience. Faithfulness to duty, self-discipline, or stern justice constitute the core of morality for all who exercise authority in the state, the community, or the family. It was especially the neo-Confucianism of the Chinese philosopher Chu Hsi (1130–1200) which was favored, though other forms also flourished, sometimes manifesting such a high degree of independence of thought that the government found it necessary to restrict their freedom. Names of such Confucianists as Fujiwara Seikwa (1561–1619), Hayashi Razan (1583–1657), Nakae Tōjū (1608–1648), Hayashi Shunsai (1618–1680), Itō Jinsai (1627–1705), Kaibara Ekken (1630–1714), Arai Hakuseki (1656–1726), and Muro Kyūsō (1658–1734) indicate that the intellectual leadership had passed from the Buddhists who had held it so long. Another marked change was that, whereas Buddhists, especially Zen scholars, had formerly been friendly toward Confucianism, in this period antagonism developed between the two religions. Not only were the neo-Confucianists anti-Buddhist, but many were virtually antireligious or indifferent to religion, their major interest being political philosophy or

humanistic ethical teachings. Nominally they and their families continued some connection with Buddhism, and when a death occurred last rites were performed by Buddhist clerics, but beyond this they had little interest in religion.

One school of Confucian scholars not satisfied with the neo-Confucianism of the Shushi (Chu Hsi) or the O-Yōmei (Wang Yang-ming) schools turned its attention to the older Confucianism. This in turn led to an interest in Japan's own older literature and religion, including ancestor worship and the Shintō doctrine of the descent of the imperial family from the divine ancestress Amaterasu. As good Confucianists, they stressed loyalty to the feudal lord, but some began to see that the Tokugawa shoguns who had so zealously sponsored neo-Confucianism in the interest of their own regime were really usurpers.

A parallel movement begun by the Buddhist monk Keichū (1640–1701) put in vogue the study of national antiquities, which was later brought to fruition by such Shintō scholars as Kamo Mabuchi (1697–1769), Motoori Norinaga (1730–1801), and Hirata Atsutane (1776–1843). From their studies arose a pride in Japan's ancient faith as opposed to the imported Buddhism and Confucianism. This in turn became one of the major factors in restoring the imperial authority in 1868. It also resulted in the appearance of new Shintō sects which gradually severed their connection with Buddhism in the interest of a pure national faith. It was, of course, impossible for them to divest themselves of the age-long Buddhist and Confucian influences, and hence these Shintō sects were really syncretistic in their teachings. Some of them were fairly faithful to the typical Shintō emphasis on loyalty to the heaven-descended ruler, but even these showed the influence of Japan's Buddhist and Confucian heritage. Other sects were virtually Confucian in temper and motivating ideals. And still others stressed not only decidedly Buddhist elements, but also, in their later developments, showed the influence of Christianity, especially in their monotheistic trends. One and all of these Shintō sects had moved far from the sort of religion we find in the early Shintō documents.

What made all of these movements really significant beyond their religious aspects was the part they played in the political developments leading to and following the restoration of the emperor to his rightful place in 1868.

Religion As an Instrument of an Expanding State (1868–1945).—With the restoration of 1868 a new situation was created for religion. Shintoists and Confucian samurai who had taken the lead in the restoration undertook the establishing of a national religion subservient to their interests. The age-long Shintō-Buddhist amalgamation was dissolved. Buddhist priests were ejected from Shintō shrines, Buddhist scriptures and ceremonial objects were burned, and much temple property was confiscated. In short, Buddhism, which for centuries had had a privileged position, was deposed.

These severe measures, however, proved unpopular, and in 1872 an arrangement was made which allowed both Buddhists and Shintoists to manage their own internal affairs with the understanding that they would serve the interests of the state by sponsoring "patriotic and humanitarian principles." The young samurai leaders who had led the restoration movement were little interested in religion as such. Their major con-

cern was a strong state which could hold its own against the aggression of Western powers. To achieve this objective they were ready to learn from these powers and to take whatever measures were necessary to avoid any conflict with them while Japan was weak. That is one reason why in 1873 the edicts against Christianity were removed from the public notice boards and this religion, which had been feared and suppressed for some 250 years, was at last permitted to carry on its work.

In the charter oath taken by Emperor Meiji in 1868, the 5th article stated that "knowledge shall be sought for throughout the world. . . ." Thus when Christian missions established their schools and churches in various cities ambitious young men, including many from the samurai class, were eager to learn from these representatives of the Western World. Christianity became quite popular, probably more for what it brought in its train than for its own essential religious message, though a growing number of Japanese became real converts. In fact, during the 1880's, Christianity was making such an impression on Japan that some officials proposed recognizing it as the national religion. Even some missionaries, believing that their work was no longer seriously needed, returned to their homelands.

It was perhaps natural that this wave of enthusiasm for things Western should be followed in the 1890's by a reaction. Some of the more conservative Buddhists took the lead in anti-Christian movements. They were joined by Shintoists and Confucianists, who were ready to forget their past differences, in forming an organization sometimes called the Great Way Uniting the Three Religions. Some of the leaders were familiar with writings of Western philosophers critical of Christianity, and so they attacked Japanese Christianity as being both anti-Japanese and outmoded in the Western World. This anti-Christian movement, however, was soon overshadowed by the war with China (1894-1895) and the Russo-Japanese War (1904-1905), which tended to unite all Japanese in an ardent nationalism irrespective of religious differences. Japan was well launched on her career as an expanding military state, in which religion often became little more than an instrument of the government instead of preserving its own sovereign rights.

Accompanying this nationalistic spirit was a strong trend toward secularism and indifference to religion. This secularism had its most far-reaching effect through Japan's rapidly developing educational system, which borrowed much from the Western World in the field of the natural sciences and all that makes for industrial progress and military power, but little in things of the spirit. That area of life was supposedly provided for in the Imperial Rescript on Education of 1890. This rescript, largely Confucian in content insofar as it dealt with moral ideals, was proclaimed as representing "the teachings of the Imperial Forefathers," and its aim was the unification of national morality. It soon became a sacred text from which teachers were supposed to derive all that was needed for moral training. Religion as such had no place in public schools and only a very restricted place in private ones. This was not so much separation of church and state as the ignoring of religion and the substitution of the all-sufficient "religion of patriotism" zealously fostered through so-called State Shintō.

State Shintō was called into being during the

1880's after an earlier attempt to make traditional Shintō the state religion had failed. The government by decree divided Shintō into two divisions: State or Shrine Shintō, and Sectarian Shintō. State Shintō, the government leaders explained, was not a religion but a cult of patriotism in which all loyal Japanese could participate irrespective of the religious views they might hold privately. Sectarian Shintō, on the other hand, was to be regarded as a religion and as such equal before the law with Buddhism and Christianity. In the Japanese Constitution of 1889 all recognized religions were given a certain degree of freedom to manage their own affairs and to propagate their faiths. The government exercised control but gave them little encouragement, while at the same time it fostered State Shintō with increasing zeal as Japan advanced steadily toward world power. The restrictions placed upon the recognized religions, though real, were not fatal, and so each of the three religions—Shintō, Buddhism, and Christianity—made fairly substantial headway during most of this period.

Buddhism, which had lost much property, made up for this loss by greater activity in educational, literary, and social service fields. By 1940 the 56 sects and subsects maintained more than 70,000 temples in good repair. Adherents numbered about 45,000,000, though many of these were nominal only. Some sects, particularly Jōdo Shinshu, followed Japanese citizens beyond the borders of the empire and in other ways adapted their work to meet the needs of modern life.

Sectarian Shintō, with its 13 sects, claimed about 17,000,000 adherents. Some of these, especially Tenrikyō, manifested a marked missionary zeal both at home and abroad. In several there was a notable doctrinal restatement by which the myriads of gods of the old Shintō records were replaced by a monotheistic faith. The characteristic Shintō emphasis on loyalty to the ruler was maintained by most of these sects, though there were trends among minor Shintō groups not recognized by the government which seemed subversive and so were suppressed.

Christianity showed a slow but steady advance. Adherents numbered upwards of 300,000, with approximately two thirds Protestants and one third Roman and Orthodox Catholics. Probably 1,000,000 or more could be regarded as affiliated with Christianity. Moreover, Christian influence was considerably greater than the number of professed adherents would indicate.

From time to time the government, concerned about evidences of corruption in society, called together representatives of the three religions, urging them to do more in the way of moral instruction and guidance. After World War I, when Communist influences began to manifest themselves, some officials looked especially to Christianity to combat them. These friendly gestures by officialdom were not taken too seriously, however, since those who made the gestures did not take religion very seriously themselves and at best looked upon it as an instrument of state.

This attitude became increasingly evident through the way in which State Shintō was fostered after the mid-1920's. The wave of internationalism which spread over Japan for a few years after World War I began to ebb, and the nation came more and more under the dominance of military leaders whose religion was an intense nationalism. The cult of State Shintō assumed menacing proportions. The Imperial Rescript on

Education and the imperial pictures became more and more sacred. They were often housed in special sanctuaries in schools, and when brought forth on stated occasions they were handled with reverent care. While the pictures were unveiled and the rescript read, the assembled faculty and student body bowed low. The reader's voice trembled in fear lest he mispronounce some word and so be eternally disgraced. Some school principals actually committed suicide in expiation for such an error.

Compulsory attendance at ceremonies conducted at State Shintō shrines was another way in which this religion of patriotism made its demands. These ceremonies contained elements of traditional Shintō, and so Christians and some Buddhists found it difficult to conform. Some of the State Shintō shrines had for centuries been sanctuaries where the *kami* were worshiped and in the eyes of the public continued to be regarded as religious shrines. Therefore participation in the ceremonies was interpreted as a religious act and not simply an expression of loyalty to the throne. Nevertheless, under pressure and with the repeated official affirmation that participation did not compromise non-Shintoists, most of the Christian and Buddhist schools conformed. In Christian schools it was customary to hold a Christian service at which it was explained carefully that Christians worship God alone and that they attend the State Shintō ceremonies only as an expression of patriotism and loyalty to country and ruler. While this could be done with a clear conscience in Japan proper, in annexed territories, such as Korea, the problem was more difficult for the reason that military officials often stressed the religious meaning, including the old Shintō doctrine of the divinity of the emperor.

In short, the whole trend at the end of this period was to subordinate all areas of life, including the individual's soul, to what the military leaders regarded as the highest interest of an expanding military state, a state which had as its foundations the Shintō myth about the divine descent of the Japanese emperor who, as they boastfully proclaimed, was destined to rule over all of eastern Asia, if not the whole world.

Postwar Religion.—Japan's defeat in 1945 had a decided effect on religion. State Shintō, with its tax-supported shrines and compulsory attendance at stated ceremonies, has been abolished. (Certain historic shrines like Ise continue, however, as ceremonial places for the imperial family and high public officials.) Sectarian Shintō, like other religions, enjoys complete freedom. This freedom, however, has resulted in the proliferation of "new religions," most of which are registered as Voluntary Shintō. Buddhism participates in the new freedom but has been faced with financial difficulties in rebuilding its war losses, and this has led in some cases to strife and divisions. Japanese Christianity has not only shared in the new freedom, but has also enjoyed great support from abroad. Roman Catholicism has shown a new vigor and a corresponding increase in membership. In Protestantism the United Church, embracing about two thirds of all Protestants in Japan, has increased substantially in membership and influence. The new freedom and unprecedented opportunities, coupled with the closing of the doors of Communist China, also have resulted in the influx of many new American sects.

All in all, religion faced a new challenge in post-war Japan.

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14. CULTURAL LIFE. In considering Japanese cultural life, primary emphasis will be placed on present day education, with lesser attention being devoted to other aspects of culture, such as exchange of persons, youth organizations, literacy, libraries, institutes, learned societies, and museums.

EDUCATION

Education in Japan before the nation's surrender to the Allied powers in 1945 was highly centralized and thoroughly nationalistic in its organization and aims. Great emphasis was placed on rote learning and very little original thinking was allowed. Textbooks and teachers' manuals were prepared by the Ministry of Education and contained much factual information, but they were not designed to encourage free and unfettered thought on the part of either students or teachers. Entrance to higher schools and assignments to better positions were achieved on the basis of competitive examinations, with often the candidate who could accumulate the greatest amount of facts and write the fastest being given the promotion. The relationship between teacher and student was thoroughly feudalistic, the former showing a paternal concern for the well-being of the latter, and the latter giving unquestioning belief in, and obedience to, the former. As a government official and representative of the emperor, the teacher's word was law.

War Damage.—Great was the damage done by World War II to education in Japan. Four thousand school buildings and 80 per cent of the textbooks and equipment were completely destroyed by bombing. Far greater, however, was the damage done to the minds and spirits of students, teachers, and people in general. The war resulted in thousands of minds being warped by fear, hatred, pride, greed, uncertainty, and hopelessness. The Japanese people felt that they had been tricked and deceived by their leaders. They had lost face before Asia and the world. Students were cold, hungry, tired, and despondent. Teachers were ragged, undernourished, overworked, and dispirited, those who were not killed having been forced to leave their schools because of lack of food, shelter, and adequate salary. To heal the wounded spirits of the people of Japan and to develop a new outlook on life would entail a long period of wise, sympathetic, and thoroughgoing re-education.

Education Under Allied Occupation.—*The Task.*—To reform and regenerate education in Japan was one of the most important tasks of the supreme commander for the Allied powers (SCAP). The Education Division of SCAP was given responsibility for (1) the removal of all ultranationalism and militarism from the

school system, and (2) the complete reorganization of education so as to insure the training of administrators, teachers, and students for a democratic Japan. Directives were issued by the supreme commander to the Japanese government, which passed laws, ordinances, and instructions to implement them.

United States Education Mission.—In March 1946, the United States Education Mission to Japan, composed of distinguished educators, arrived in Tokyo on the invitation of Gen. Douglas MacArthur and for four weeks conferred with Japanese educational leaders and inspected school plants and equipment. The mission then submitted to the supreme commander a comprehensive report which in brief recommended the decentralization of the educational system through prefectural and local administration of primary and secondary schools; the revision of the morals, history, and geography textbooks; a broad health program with increased emphasis on vocational training at all levels of education; the formation of a language commission to effectuate drastic reform in both the written and spoken languages; the extension of compulsory education for nine years or until the student reached the age of 16; the establishment of tax-supported, tuition-free, coeducational schools on the basis of six years' elementary, three years' lower secondary, and three years' higher secondary education, leading to higher education; the modification of teaching methods so as to eliminate memorization and to encourage independent thinking; the re-education of teachers, school administrators, and supervisors; the encouragement of adult education, and the establishment of parent-teacher activities, extension classes, and libraries; the liberalization of the curriculums of junior colleges; the establishment of more and better universities; and complete freedom from government control of all institutions of higher learning.

Japanese Educational Reform Council.—This council, composed of 49 members distinguished in the fields of education, religion, culture, business, politics, and economy, was established on the Cabinet level by imperial ordinance on Aug. 10, 1946. Yoshishige Abe, former minister of education, was made chairman, and Shigeru Nambara, president of Tokyo University (formerly Tokyo Imperial University), was chosen vice chairman. Although it operates autonomously, the council has maintained close liaison with the Japanese Ministry of Education. In general, the council expressed approval of the recommendations of the United States Education Mission. It also made broad and extensive recommendations on the elimination of bureaucracy, equality of opportunity in education, decentralization of educational administration, the establishment of research institutes and postgraduate courses in universities, the improvement of the status of teachers, and the reform of the entire educational system.

Far Eastern Commission.—Another group that contributed no little to the postwar reform of education in Japan was the Far Eastern Commission (FEC). That body, meeting in Washington, D.C., sent in April 1947, as a directive to SCAP, a short but comprehensive statement entitled "Policy for the Revision of the Japanese Educational System." This directive emphasized that education should prepare all Japanese for life in a democratic nation, enabling them to exercise the political and social responsibilities which freedom entails. To accomplish this aim it was necessary

to reform the training, recruitment, and treatment of teachers; to make drastic changes in textbooks, curriculums, and teaching methods; to develop adult and vocational education; to decentralize Japanese education; to provide equal opportunity for both sexes at all levels of education; to forbid discrimination against graduates of private schools in civil service appointments; and to encourage the formation and reorientation of parent-teacher and educational associations to consider practical problems of education. The Ministry of Education and the Japanese Educational Reform Council have undertaken measures for carrying out most of these recommendations.

Kindergartens.—The lowest institutions in the educational ladder are the kindergartens, ministering to children 3, 4, and 5 years of age. Enrollment is entirely voluntary, and a small tuition fee is generally charged. In 1938 there were more than 2,000 kindergartens, of which two thirds were privately operated, with a total enrollment of 270,000 children. During the war almost all kindergartens were closed, but after the surrender many were reopened, and by April 1949, 1,785 were listed, with 8,438 teachers and 228,628 children. At these institutions the following subjects are used or taught: music, stories, painting, construction, nature studies, drama, social studies, health education, rhythms, rest, free play, and excursions.

Elementary and Secondary Schools.—Compulsory and tax-free education begins with the elementary or primary school. Though first established in 1872 as required schooling, elementary education has, since the surrender, been completely reorganized in administration, curriculum, textbooks, teaching methods, and aims. The old educational system was strictly regimented and highly centralized. The bureaucratic spirit was widespread from the official in the Ministry of Education down to the elementary school teacher. The principal ruled his faculty and students with an iron hand, demanding unquestioning obedience, but in turn gave the same obedience to the inspectors and supervisors sent down from the capital. From the beginning of the occupation bureaucrats fought stubbornly against decentralization, which they knew would destroy their power, but in spite of their determined opposition new basic laws of education were promulgated.

Fundamental Law of Education.—This law, which came into force on March 29, 1947, states: "Education shall aim at the full development of personality, striving for the rearing of people, sound in mind and body, who shall love truth and justice, esteem individual value, respect labor and have a deep sense of responsibility, and shall be imbued with the independent spirit, as builders of the peaceful state and society." It also provides for equal opportunity in education, without discrimination on account of race, sex, social status, economic position, or family origin, and for coeducation, home education, and education carried out in places of work. It recognizes the value of politics and religion in life, but directs that schools established by state and local bodies refrain from teaching these subjects.

School Education Law.—This law, effective April 1, 1947, provides for the establishment of sufficient primary or elementary and secondary schools to accommodate school-age children in each city, town, or village. When necessary, however, a group of communities may organize

school unions. It directs that prefectural authorities shall have jurisdiction over public and private schools from kindergartens through high or secondary schools. The minister of education has jurisdiction over public and private universities.

Administration.—Boards of education, elected by the people, were functioning by 1950 in all the prefectures, the larger cities, and to some extent in the towns, and were soon to be extended to all local communities. The administration of elementary and secondary schools was entrusted to these boards, whose autonomy over the nature of the school program was increasing. In April 1949 there were 20,952 elementary schools, with 10,989,069 students and 304,207 teachers. Although a few new school buildings had been erected by 1950, budgetary difficulties and the scarcity of building materials prevented the carrying out of the program for the repair of war-damaged schools and delayed new construction to provide 14,000 additional classrooms. The resulting cramped conditions necessitated two-shift and sometimes three-shift class instruction in many schools. Numerous elementary schools damaged by bombing suffered complete or partial loss of classroom and teaching equipment. Some of this equipment had been replaced by 1950, but in urban centers, where the war damage was greatest, school furnishings were still deficient.

Elementary Teaching and Curriculum.—The school year in elementary schools commences on April 1 and closes the following March 31, but national holidays, Sundays, spring, summer, and winter vacations, and special holidays authorized by prefectural boards of education cut the teaching days to some 235 per school year. In many schools instruction is given six days a week, but an increasing number of prefectures have adopted the five-day week. Class size is limited by law to 50 pupils, but the shortage of classrooms has frequently necessitated crowding 60 or more children into one room. An increasing number of schools are using progressive teaching methods, the main emphasis being placed on social studies. The following subjects are taught in the regular six-year elementary school: national language (reading and writing), social studies, arithmetic, science, music, drawing, handicrafts, practical art, and physical education.

Textbooks.—The elimination of militaristic and ultranationalistic ideas from education and the need for developing a progressive and democratic curriculum in the schools resulted in the revision of nearly all the textbooks of the nation after the surrender. Scores of educators and others interested in writing textbooks daily visit the 13 textbook and curriculum centers scattered over Japan, where they may read hundreds of modern United States textbooks and professional books on education. In spite of the very critical shortage of paper over 200,000,000 textbooks were produced during the school year which began April 1949. In January 1948, the Textbooks Commission of the Education Ministry recommended that beginning with the 1950 school year all textbooks, which had previously been compiled by the government, be replaced gradually by textbooks compiled by private authors, provided such texts met certain approved standards.

Lower Secondary Schools.—The lower secondary school, or junior high school, includes grades 7 to 9. In enforcing the nine-year minimum of compulsory education, the government allotted the buildings of the former youth schools and

higher elementary schools to the new secondary schools, but there still remained a considerable shortage of buildings. Budgetary difficulties prevented the construction of needed classrooms. This necessitated, as in the case of many elementary schools, two-shift and sometimes three-shift class instruction. In April 1949 there were 12,415 public and private lower secondary schools, with 195,383 teachers and 5,177,455 students. Each city, town, and village is normally required to provide, free of charge, educational opportunities for the entire school population in grades 7 to 9. It was expected that when the system reached full operation, cities would have several lower secondary schools, each large town or village would have at least one, and smaller villages might join other small communities in supporting a consolidated school. In 1950 many of the schools already established were still sadly deficient in classroom facilities and equipment.

The curriculum of the lower secondary schools lays particular emphasis on the development of the pupil's personality and individuality and on the ability to participate effectively in community life. It also provides vocational guidance and some vocational training.

Private Secondary Schools.—Upon completion of the six years of elementary work the pupil is automatically promoted to the lower secondary school, thus eliminating entrance examinations in public schools. The number of applicants for private secondary schools, both lower and higher, far exceeds the available openings, and students are selected on the basis of reports from elementary schools, physical examination, and personal interviews. Thus these private schools have been able to maintain their school traditions and have held to a higher standard of education than most public lower secondary schools. Private schools also do not have to adopt coeducation. Many conservative parents prefer to send their children, especially their daughters, to a private secondary school which is not coeducational. Private secondary schools are generally not so crowded as the public schools, which permits more individual attention to be given to the student.

Upper Secondary Schools.—Upper secondary schools, or senior high schools, are the connecting link between the lower secondary schools and the universities. In April 1949 there were 2,935 such schools, with 95,489 teachers and 1,624,384 students. There are two types of upper secondary schools: those offering full-time courses either during the day or at night or both; and part-time schools for working students and those in farming and fishing areas, who can pursue their subjects only during certain seasons of the year. Most secondary schools also give specialized courses in agricultural, technical, industrial, commercial, and other vocational fields. Because of the limited capacities of upper secondary schools students were in 1950 selected on the basis of competitive examinations covering the Japanese language, the social sciences, and mathematics, but considerable attention also was paid to reports from the lower secondary schools on achievement tests, physical examination, and personality. Like the lower secondary schools, the upper secondary schools are under the control and administration of the prefectures. Coeducation is encouraged but is not mandatory, and a relatively small tuition fee is charged. In 1950 it was expected that these schools would eventually be



Above: Mount Fuji, the highest mountain in Japan, and once an object of worship, is now a Mecca for mountain-climbing tourists and a widely recognized national symbol.

Above right: A worker selects cultured pearls for stringing into necklaces. Blue bowls contain pearls sorted for size.

Orion Press, Tokyo



JAPAN

Right: Transistor manufacturing near Tokyo. Radios, televisions, and other electronics items have become a major export industry.

Below: Part of the vast Tokyo-Kawasaki-Yokohama industrial area, source of much of Japan's manufacturing output.

(Right) SONY; (below) Orion Press





Above: Kimono silks in traditional designs, after being dyed and then rinsed in water, are laid out under the sun to dry.



Left: Sunlit terraced rice fields, neat gray-roofed dwellings, and distant woods—a typical landscape of Japan.

(Top) D. Forbert from APA; (left) Ferenc Berka from Pix Inc.; (bottom left) Frederic Olson from Shostal; (bottom right) Ronny Jacques from Photo Researchers

Below left: A bamboo craftsman. The handicraft of making baskets and other bamboo products has survived the onrush of civilization.

Below: A Kyoto maiko (student geisha) arranging flowers. Kimono, golden sash, and hair ornaments comprise traditional costume.





Above: A ship under construction at the Hitachi shipyards, Osaka. Japan is one of the world's leading shipbuilders.



Above right: Scene at the Yawata Iron and Steel works on Kyushu Island. The plant is the largest of its kind in the Orient.

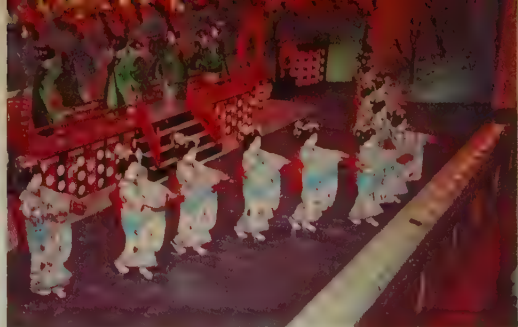
(Top left) T. Fujihira from Monkmeyer; (top right) D. Forbert from APA; (others) Frederic Olson from Shostal

Right: A fresh food market. Vegetables, shown in colorful profusion, are served in a vast variety of ways with fish, rice, and meat.



Below: Threshing wheat in Tottori Prefecture. Although rice is the staple food, wheat and barley are also important in the diet.





Above: Geisha in symbolic costumes perform the Cherry Blossom Dance, climax of a fete presented twice yearly at the celebrated theater, Minamiza, Kyoto.

Left: Autumn scene—a Japanese woman, in typical working clothes, tends her radish patch under the fruit-laden boughs of a persimmon tree.

(Top right) Nyle Leatham from Pix Inc.; (left) Orion Press, Tokyo

JAPAN



Above: Two charming young *maiko* in traditional kimono pose before a famous Buddhist temple, the Daigoji, which dates back to the year 951.

Left: The moss garden of Saihoji (also known as Kokedera or Moss Temple). The garden is carpeted by moss of many beautiful species.

free, and that there would be enough of them to take care of all graduates of the lower secondary schools who desired to continue their education.

There are a number of elective courses in the curriculum of the upper secondary school. In addition to the required subjects of Japanese language, social studies, mathematics, natural science, and physical education, the student may select from a comparatively wide range of electives the special subjects which interest him and may be of use in his chosen profession. Upon graduation the student may sit for the entrance examination of any university. Eventually upper secondary schools were to be well-equipped, well-housed, and adequately staffed institutions, but in 1950 they were still greatly handicapped by economic obstacles and shortages.

Vocational Training.—In view of the urgent need for trained personnel to aid Japan in her economic recovery, many courses are given in upper secondary schools, colleges, and universities which "are designed to provide students with the technical knowledge and skill necessary to qualify them for successful employment in specialized occupations on the vocational level." Vocational education is also provided for public service occupations such as the fire and police systems and the civil service. Modern programs of education and rehabilitation are provided in prisons and reformatories. Vocational and special educational activities are carried on for blind, deaf, crippled, or otherwise handicapped persons.

Teacher Training.—*Reorientation.*—In the reorganization and reformation of Japanese education great stress was laid upon the proper training and reorientation of teachers. An early SCAP directive called for the elimination from the educational system of all persons known to be ultranationalistic, militaristic, or antagonistic to the objectives and policies of the Allied occupation. Steps were also taken for the reinstatement of properly qualified teachers and educational officials who had been purged by the Japanese militarists since July 7, 1937. Committees were set up to investigate and screen all educational personnel, and to certify all who were found to be properly qualified. Of the approximately 600,000 teachers in Japanese elementary and secondary schools, about 120,000 resigned or were purged between August 1945 and April 1947. The teachers who survived the purge and those who were newly appointed were sent to teacher training institutes, vacation schools, and refresher courses for reorientation. For the re-education of teachers, the Ministry of Education prepared courses of study to cover the various subjects taught in the schools. Teachers were learning to think for themselves. A new generation of Japanese was being trained to act and speak as independent individuals. Emphasis was placed on personality and character development as well as on intellectual training, not on regimentation and subordination to the state, as was the case before the surrender.

Organizations and Training.—Teachers' associations of all kinds including teachers' unions have been organized. The aim of the latter is to improve the economic condition of teachers, for as a profession they are grossly underpaid. Each year teachers hold many conferences for the exchange of information and the consideration of practical problems of education. Normal school courses have been modernized, and universities are offering courses in education, psychology,

teaching methods, school administration, educational research, and other subjects. Books, pamphlets, and magazines for the teaching profession have appeared in increasing numbers.

Adult Education.—For the prewar adult education, which was completely under government control, there have been substituted various educational programs for training in citizenship and in the development of leadership. Parent-teacher associations have rapidly grown in influence and number and have increasingly accepted new and larger responsibilities. Citizens' public halls have been established in local communities. The halls are managed by local boards and provide opportunities for the townspeople to practice democratic procedures. In many communities books, radios, motion picture projectors, and athletic equipment have been purchased for use in the halls, thus making them the cultural and social centers of the district, town, or village. Correspondence and extension courses have been established, with a full-time teacher for each 100 correspondents. Leading private universities, such as Keio, Waseda, and Hosei, offer correspondence courses for in-service training of elementary and secondary school teachers. To preserve the old arts and to promote new cultural forms, various essay, drama, music, and art contests are sponsored throughout the country.

Audio-Visual Education.—In the program for reorientating Japanese education, audio-visual media have been used very effectively. In nearly all institutions of learning, motion pictures, film strips, and phonograph records have provided supplementary teaching material which has been integrated into the courses of study. The Educational Film Exchange, operated by SCAP, has provided a large number of Allied educational and documentary films, to which sound tracks in Japanese have been added. Radio broadcasts to and from schools have proved to be very effective media for democratic education.

Higher Education.—Before the surrender, Japanese institutions of higher education, like the primary and secondary schools, were under government domination. The prestige of the six imperial universities was so great that 40 per cent of the graduates went into government service. Graduates of private universities were greatly handicapped in securing positions either in government service or in private business organizations. Only a few women were admitted to the universities. Competition among men applicants was so keen that selection was made through an examination system which stressed rote memory to the exclusion of many other important qualifications of a good student.

After 1946 many important changes were made in higher education. The three-year universities were changed to four-year institutions, and by improving the curriculums and standards of other colleges many new four-year universities were added. The University Accreditation Association, an autonomous body independent of governmental control, was established to evaluate university work in terms of credit and to make certain that minimum standards of curriculums, instruction, and equipment were met. Accredited universities enjoy privileges of transfer of students from one institution to another without loss of credit. The University Chartering Committee was established on Jan. 15, 1948, under the supervision of the minister of education, to "make inquiries and deliberate on matters concerning

approval of the establishment of universities as well as the doctorate and other academic degrees. . . . Plans were also made to establish graduate schools in certain qualified universities. The new universities, which presumably would have full administrative autonomy, were placing special emphasis on general education as a preparation for later professional training.

The physical plants of many colleges and universities in the large cities were severely damaged by bombing. Because of the lack of building materials and economic resources, only relatively few of the damaged buildings had been repaired or rebuilt by 1950. Nonetheless, on April 1, 1950, there were 197 fully accredited four-year universities, of which 68 were national, 25 public, and 104 private. In addition, there were 150 two-year junior colleges. Over 500,000 students were enrolled in these institutions of higher learning. Many of the universities were coeducational, women being admitted on the same basis as men. Students are selected on the basis of achievement tests, scholastic aptitude tests, physical examinations, and reports from schools. Graduates of private universities may now enter government service on the same competitive basis as the graduates of national and public universities.

EXCHANGE OF PERSONS

Before World War II, a great many Japanese students and scholars went abroad for further study, training, and scientific investigation. For nearly 10 years Japan was cut off from cultural contacts with the West, contacts which had proved mutually beneficial. Recognizing the importance to Japanese cultural leaders, teachers, and students of visits to the United States for purposes of reorientation, special funds were appropriated by the United States Congress in 1949 for this purpose. Japanese leaders who have made such visits are contributing to the growth of Japan as a democratic nation. In addition, many United States specialists in all fields of culture and science were brought by SCAP to Japan to advise and assist leaders there. Since 1947 a number of private social, cultural, and educational organizations in the United States have supported financially Japanese students and cultural leaders in their visits abroad. In addition, in 1951 an educational exchange program was inaugurated under the provisions of the Fulbright Act.

YOUTH ORGANIZATIONS

The economic and social disruption of the war and postwar periods resulted in extreme confusion among Japanese youth. Militaristic and ultranationalistic youth leaders were purged, and it was difficult to find qualified, democratically inclined leaders to take their places. By 1950, however, youth organizations were beginning to participate in programs for rebuilding Japan into a democratic nation. Among the most important of these organizations are the Nippon Seinen Kan (Japan Young Men's Hostels), Nippon no Seinen Kai (Japanese Youth Associations), the Boy Scouts, the Girl Scouts, the Junior Red Cross Society, and the Young Men's and Young Women's Christian Associations. The two last-named organizations are actively engaged in leadership programs along spiritual, moral, and social lines, with special emphasis upon the importance of international relations.

LITERACY

The question of literacy in Japan is intimately connected with the problem of language reform. If by literate we mean the ability to read kana (Japanese phonetic symbols), it would be safe to say that nearly all Japanese from the age of 6 upward are literate; but if the criterion of literacy is the ability to read and understand completely the newspapers, which are printed in an admixture of Chinese ideographs and Japanese phonetic symbols, it is doubtful whether 60 per cent of the population can be considered literate. The United States Education Mission to Japan recognized that the intricacy of the Japanese language is a great obstacle to the democratic development of the people. Consequently, it recommended that steps be taken to simplify and romanize the written language. While that recommendation has not been fully adopted, Japanese leaders recognize the need for language simplification, and are endeavoring to solve the problem by teaching Romaji (Jap. *rōmaji*, or Roman letters) in elementary schools, by reducing the number of Chinese ideographs to be taught in elementary schools, by encouraging newspapers and periodicals to stay within that prescribed number, and by promoting the use of simple language in both writing and speaking.

LIBRARIES

The Ministry of Education, reporting on the condition of libraries in Japan on May 1, 1946, listed 3,398 libraries, of which only 874 contained 3,000 or more volumes. Most of the largest Japanese libraries are in urban areas where they suffered heavy loss from bombing, and consequently were still in a state of confusion in 1950. For example, the Tokyo Metropolitan Library with its 27 branches lost, during the incendiary bombing, one third of its collection of 700,000 volumes, while the Nagoya Municipal Library lost 93,000 volumes out of a total of 160,000. Statistics indicate that 138 libraries were heavily damaged or entirely demolished. It was recognized that there was great need for revising and reforming the whole library system. This was being accomplished by giving libraries greater financial support from government and private sources, by improving the training and raising the professional standing of librarians, by making libraries more accessible and attractive to the public, by establishing in each prefecture and large city at least one good free public library, and by improving school and university libraries. The Japanese government has made appropriations for expanding and improving the Diet Library, and two prominent United States librarians have assisted in studying and solving the problems connected with this institution.

Information Centers.—In the forefront of the battle for more and better libraries were the 17 information centers conducted by the Civil Information Section of SCAP, which were located in the major cities and four main islands of Japan. These served as small but well-staffed and carefully equipped models for Japanese libraries. Each center contained at least 6,000 books, 400 periodicals, and several thousand pamphlets and documents, all in English (which many Japanese can read), and covering all fields of knowledge. They were easily accessible to the public and free of charge. Not only the general public, but hundreds of Japanese government officials, political and labor leaders, industrialists,

physicians, research workers, teachers, and students availed themselves of the excellent facilities of the information centers, where they received the latest and most authoritative information in international affairs, research, technology, World War II, and "the policies and activities of the United States as they develop from American customs, institutions and government." At each center films were shown, United States music was played, English language classes and discussion groups were held, and numerous other activities took place. Many of these centers extended their usefulness by depositing United States books, magazines, films, and records in adjacent Japanese schools and public libraries.

INSTITUTES AND LEARNED SOCIETIES

Some professional and learned societies have training and research institutes, but the Institute for Educational Leadership, which was sponsored jointly by the Japanese Ministry of Education and the Education Division, Civil Information and Education Section of SCAP, has been outstanding in meeting a real need in the field of Japanese education. The institute, with 21 United States and 26 Japanese specialists on its staff, conducted courses in 1948 and 1949 for the training of elementary school consultants, secondary school consultants, superintendents and professors of education, youth leaders, university administrators, and student guidance personnel. A total of 3,700 persons completed the training and returned to their communities to assume active leadership in guiding and educating youth in all parts of Japan. In March 1948 there were 253 Japanese learned and professional societies in 60 different fields of science and culture.

MUSEUMS

As depositories of culture, both ancient and modern, museums have an important place in Japanese education. Many of the fine collections, especially those in urban areas, were badly damaged by bombing, and those that remained were greatly disorganized. The Religions and Cultural Resources Division, Civil Information Section of SCAP, greatly assisted the Japanese government with advice and recommendations regarding the financing and management of many projects for the preservation, protection, restitution, and restoration of antiquities, archives, cultural treasures, art collections, and museums. In spite of the financial limitations of individuals as well as public organizations, by 1950 much had been done along these lines.

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15. SCIENTIFIC RESEARCH. Although science as understood in the Occident developed in Japan after the Meiji Restoration of 1868, the Portuguese had introduced certain aspects of Western science, such as medicine, navigation, cartography, and gunnery, in the 16th century. This section emphasizes the relation of scientific research to the development of modern Japan, with minimum attention being given to individual achievements in specific fields.

Pre-Meiji Science.—For the greater part of the three centuries prior to the Meiji Restoration the Tokugawa shoguns had forbidden all Japanese to leave the country and had prohibited the entry of foreigners, excepting only the annual Dutch factory at Nagasaki. Hence ambitious youths thirsting for the arts and sciences of the West surreptitiously made their way to Nagasaki. By 1774 this group of so-called Dutch scholars was able to translate and publish a Dutch work on anatomy, the first European work to be printed in Japan. And by the end of the 18th century translations of standard European works on astronomy, mathematics, medicine, and botany had been published. In appraising their work, the difficulties met by these scholars must not be forgotten. Foreign books, virtually banned by the government in its enforcement of the seclusion policy, had to be obtained, and the more formidable problem of learning the Dutch language and of coining appropriate Japanese terminology had to be overcome. In 1823, Philip Franz von Siebold, a German physician in Dutch employ, arrived in Nagasaki and initiated lectures on clinical medicine; later he opened a school where young Japanese who braved the difficulties of learning the Dutch language might study medicine and botany. Tacitly conceding the value of medical knowledge, the shoguns winked at these illegal activities. Thus, knowledge of Western medicine continued to grow. In time the Japanese turned from the translation of Dutch works to British and United States treatises. On the eve of the restoration the Japanese were not only studying the medical science of Great Britain and the United States, but were also using the personal services of doctors from these countries.

Meanwhile, the Japanese were investigating the intricacies of other sciences. Gennai Hiraga, for example, had acquired some knowledge of electricity while visiting Nagasaki. He returned to Edo (now Tokyo), built an electrostatic machine, and demonstrated it publicly. The shogun, however, deemed Western learning politically dangerous, and Hiraga was punished severely for "misleading the public with Western magic."

It should be noted that during this period certain advances independent of Western influence had been made in some aspects of science. In mathematics the numerical solution of equations of higher degree had been mastered by the Japanese without the assistance of the West, and Kowa Seki had conceived and utilized the idea of determinants in his calculations. In surveying and cartography, Ino Chupei had accomplished the feat of surveying and mapping the shoreline of Hokkaido a few years before von Siebold's arrival in Japan. Astronomy also had long been a subject of interest to the Japanese because of its importance to navigation and calendar making. Careful records of astronomical phenomena had been kept and preserved for centuries. In descriptive biology some notable catalogues had been compiled. But even with these sciences it re-

maintained for Western science, with its methodology and experience, to provide the stimulus and guidance for their further development.

From the Meiji Restoration to World War I.—The Meiji Restoration repudiated the isolation policy of the Tokugawas and actively fostered the introduction of Occidental knowledge. Science, however, requires a foundation of mass education; although the Meiji government established a compulsory educational system, some 20 years elapsed before Tokyo Imperial University (founded in 1877) could assume the form of a truly modern institution. Its early faculty included such distinguished Westerners as Sir James A. Ewing of Great Britain (physics), R. W. Atkinson and S. Divers of Great Britain (chemistry), and Edward S. Morse of the United States (zoology). Until 1900 most of the medical chairs were occupied by Germans, to whom the Japanese had turned upon learning that German medicine was then far in advance of that of other countries. Among them, E. O. E. von Baelz was outstanding. Japanese scholars, trained abroad at government expense, returned home to lead in education and research. Notable among these scientists were Dairoku Kikuchi, in mathematics; Kenjiro Yamakawa, in physics; Naokichi Matsui and Joji Sakurai, in chemistry; Kiyokage Sekiya, in seismology; and Ryokichi Yatabe and Masakazu Toyama, in botany. As additional imperial universities were established and private institutions took shape, science developed apace.

By 1900, European scientific journals were carrying reports of research by Japanese scientists. Perhaps the first Japanese achievement to draw international attention was the discovery of the so-called Z-term by Sakae Kimura, professor at Tokyo Imperial University. At an international scientific conference on the variations in position of the earth's axis, Mizusawa in northern Japan was selected as one of many scattered observation points. Professor Kimura offered to conduct the observations. At a subsequent conference, the results of observations in various countries, except for Kimura's data, conformed consistently to a simple mathematical formula. The discrepancy was explained away on the basis of inferior technique, but Kimura remained unconvinced and stood by his data despite the censure of his Japanese colleagues. He then returned to his observatory and analyzed his data mathematically. He discovered that by correcting the formula by the addition of what he called the Z-term his conclusions could be aptly expressed. European scientists tested his revision of their formula and vindicated his observations. The Japanese public heralded this incident as proof that Japan's science now equaled that of the West—a conclusion congenial to the intense nationalism that followed the Russo-Japanese War. The Imperial Academy of Japan established the Academy Prize, and Kimura was the first Japanese scientist to be thus honored.

Japanese scientists themselves disliked such publicity, for they were quite aware of the fact that the level of science in Japan averaged below Occidental standards. Gradually, however, research in other fields began to draw attention from scientists in Europe and the United States. Hantaro Nagaoka of Tokyo Imperial University developed a theory of atomic structure; at the same institution, in 1910, Umetaro Suzuki discovered vitamins, and Kikunae Ikeda discovered *aji-no-moto* (essence of taste), a discovery in

which United States scientists showed interest after World War II.

Professor Nagaoka's model of the atom—as electrons revolving about a positively charged heavy particle—anticipated the discovery of the atomic nucleus by the 1st Baron Rutherford of Nelson; Niels Bohr used a similar model in his quantum theory. In older discussions, this model was termed the Nagaoka-Rutherford-Bohr model.

Professor Suzuki's independent discovery of vitamins generally had not been accorded priority over the discoveries of Occidental scientists. At that time the authenticity of Japanese scientific journals was not accepted, and Suzuki lost the opportunity to assert prior discovery. To correct this situation the Imperial Academy decided to publish monthly periodicals in English and other foreign languages. In due season these journals achieved international acceptance.

Professor Ikeda's discovery of *aji-no-moto* has been important in applied science. The product has enjoyed worldwide sale as a means of intensifying the flavor of foods to which it is added.

Meanwhile, the science of seismology was making phenomenal progress. Within a few years after its introduction in the 1870's, the Japanese, through Kiyokage Sekiya and Fusakichi Omori, gained international renown. Among the achievements of this group of scientists was the perfection by Aikitsu Tanakadate of the parallel-motion seismograph and of the spiral seismograph for recording vertical motion.

In geology and mineralogy the Japanese had taken over the teaching of these sciences at Tokyo Imperial University from their Western tutors by the late 1880's. And by 1896 Japanese botanists had made a notable contribution to the science of plant morphology by their discovery of spermatozoids in the pollen tubes of the ginkgo and cycad.

In technology, the Japanese had been almost wholly dependent on the West. In the early decades of the Meiji era (1868-1912) importations of Western technology had gone on at a feverish pace. One notable Japanese contribution, however, was the invention of the automatic power loom by Sakichi Toyoda (1895). This machine revolutionized the Japanese textile industry.

Developments from 1914 to 1941.—World War I and the immediate postwar period constituted a very important era for modern Japan. National economic potential and living standards increased rapidly; scientific research expanded, and projects multiplied, with notable increases in the number of universities and laboratories. Outstanding, perhaps, was the work of Kotaro Honda, professor at Tohoku Imperial University and president of its metallurgical institute, who pioneered in the investigation of the magnetic properties of ferromagnetic metals and alloys. His K.S. magnet exhibited the highest permanent magnetism then known and was used widely in industry.

From its inception, however, Japanese research showed an almost fatal weakness: the lack of close coordination between science and industry. In Great Britain, for example, rapid development of science had accompanied the Industrial Revolution: the industrial development of the steam engine was inseparable from the theory of heat and thermal properties of matter. As an integral part of human civilization, science must

find its *raison d'être* in its utility for better living. Japan imported science from the Occident without maintaining its connection with the industry that also was being imported from the West. While government-aided scientists were striving vigorously for world recognition, Japanese industrialists were importing both machines and engineers from Europe and the United States, oblivious of the inevitable liaison between science and industry. Neither group should be blamed; the borrowing of an alien culture is a herculean task, and Japan had no precedent to guide her. The industrialists had to achieve a return on invested capital and the surest and shortest way was direct reliance on ready-made, well-tested products from the West.

Understandably, if unwisely, the scientists reacted by taking refuge in an ivory tower of academic isolationism and by looking down upon industrialists as mere money grubbers. This deeply rooted attitude of Japanese scientists has blocked progress. Professor Honda's work with magnetism was one of the happy exceptions: the institute over which he presided was a gift from the industrialist Kichizaemon Sumitomo. Many of the findings of research at this institute were developed commercially on a large scale by the Sumitomo Manufacturing Company. Honda's use of the initials K.S. to denote his new magnet was a tribute to his industrial backer. Nevertheless, it remained for European and American industrialists to apply this discovery extensively.

The Japanese government took cognizance of the separation of science and industry and, as a possible bridge over the gap, established the Institute of Physical and Chemical Research (IPCR) in Tokyo in 1916. Leading industrialists contributed large sums, laboratories were built and equipped, and noted scientists were invited to join the staff. Among them were Han-taro Nagaoka, Kotaro Honda, and Umetaro Suzuki. The plan was to support the institute from patent royalties, and the government granted a 10-year subsidy to tide it over until such support materialized.

The IPCR soon produced important inventions and became a major shareholder in numerous companies that were established to manufacture the new inventions. Among these products were synthetic sake (rice wine), different kinds of vitamins, scientific precision instruments, and piston rings. Profits from the synthetic sake and vitamins enabled the institute to attain self-support. With the general economic expansion of the 1930's and the early 1940's, the concerns affiliated with IPCR expanded rapidly and became important industrial forces.

A special feature of the IPCR was its conduct of extensive research in pure science without detracting from its industrial program. This the institute continued to do until it had to change its organization in 1945. It had maintained one of the most active research centers in Japan; its laboratories were better equipped and maintained than those of the universities, and they were staffed by capable young workers. In 1937 a very large cyclotron was begun under the direction of the distinguished physicist Yoshio Nishina; this enterprise resulted in important contributions to nuclear physics. Under IPCR auspices, Umetaro Suzuki pursued his investigations of the chemistry of vitamins in relation to nutrition. Shoje Nishikawa's study of crystal structures by X-rays and cathode rays were highly

fruitful; under his direction Seishi Kikuchi investigated the diffraction of cathode rays by crystals, which attracted attention in 1927.

The IPCR undoubtedly pioneered in the integration of Japanese science and industry. It has been criticized on the ground that it competed with other industries instead of preserving a neutral position and extending to all industries the benefits of its discoveries. Masatoshi Okochi, president of the institute from about 1930 to 1945, seemed to feel differently. If he admitted the truth of this criticism in principle, on the basis of experience he doubted whether capitalists motivated by a desire for profits would return in contributions any fair proportion of the profits they obtained from IPCR achievements. Okochi encouraged every kind of research undertaken by institute scientists; and, research being expensive, this policy entailed considerable reduction in the profits of the companies under IPCR control.

Objectively considered, it is reasonable to doubt whether a problem so large as the effective coordination of science and industry could have been solved so quickly by a single organization. As it happened, the economic improvement of the 1930's generally increased incomes in Japan, and wealthy industrialists donated large sums to universities to aid scientific research. At the same time, the Japanese Army and Navy began to support research directly and indirectly. Unhappy encounters with Soviet mechanized troops along the Manchurian border in 1938 (see section on *Foreign Relations [1931-1945]*) had convinced the army command of the need for the promotion of scientific research in collaboration with industry. The result was an appropriation by the Diet of an annual budget for research.

Simultaneously, the Japan Association for the Promotion of Science and Industry was instituted and granted government subsidies. This organization selected for investigation the most urgent problems from various scientific and industrial fields and assigned each problem to a special committee of engineers and scientists. Some of the projects, such as nuclear physics, were in pure science; others, such as synthetic oil, synthetic rubber, and improved carbon brushes for motors, were industrial. The committees encountered problems of practical psychology; engineers affiliated with competing industrial organizations were loath to pool their special techniques and secret discoveries. Furthermore, the army and navy, for reasons of security, kept their findings secret. Nevertheless, Japanese scientists were working more directly with practical problems than they had before.

All these circumstances stimulated and expanded the scope of research in Japan in the 1930's. It was then that Hideki Yukawa evolved the meson theory for which he was awarded a Nobel Prize in 1949. Two cyclotrons were operating by 1938, one at the IPCR and the other at Osaka Imperial University. While we have stressed the field of physics, analogous situations existed in other branches of science.

Science in World War II.—In 1941, when Japan became an active belligerent in World War II, Japanese science and industry lost contact with their Occidental counterparts. The test was severe; after 80 years of struggle, would they be strong enough to proceed alone?

In the field of pure science, the theoretical physicists, headed by Hideki Yukawa, continued research on the meson. Shinichiro Tomonaga

contributed to a new formulation of quantum electrodynamics; Shoichi Sakata contributed to the two meson theory and the neutral meson theory, and these played an important part in postwar theoretical physics. In general, however, the results were disheartening. Progress ceased completely in experimental nuclear physics, although at the beginning of the war nuclear physicists had urged research into atomic energy. The army and navy, acting separately, surveyed the sources of uranium-bearing minerals and soon discovered that almost no sources of uranium were within reach. Previously all uranium products had been imported; hence there were no factories for refining such minerals and the technology was almost unknown. A group of nuclear physicists tried in 1942 to obtain uranium, but got only a few pounds of uranium oxide and uranium nitrate that had been imported from Germany before the war. It was thus impossible to conduct even the fundamental studies that might have ascertained the probability of a chain reaction of nuclear fission. Hence most of the nuclear physicists turned to other projects. Even in applied science fields that were vital to the conduct of the war, activity was limited severely by the lack of an administrative policy for research and by shortages of every kind of raw material. In fact, the overcoming of these shortages was an immediate and primary concern of Japanese science after 1941. In this connection, some results were obtained in the production of methane gas from sewage and garbage, of lubrication oil from animal matter, of wool from whale collagen and fish refuse, and of synthetic fibers from an ever-increasing number of fibrous materials. Attempts were also made to supplement the power shortage by utilizing subterranean heat and water from hot springs. These developments, however, with the exception of synthetic fiber, were on an extremely small scale. Thus, except for theoretical physics, almost no progress was made during the war. There were too many handicaps; the test was too severe.

Postwar Scientific Research.—With the collapse of Japan in August 1945, the background for scientific research seemed entirely lost. The industrialists were helpless; their factories had been destroyed, and there was no capital and no means of buying machinery from abroad. The scientists were similarly helpless. Laboratories and facilities had been destroyed or neglected. The Tokyo Astronomical Observatory, which had been able to maintain contact with the Copenhagen Astronomical Observatory for a year after the start of hostilities, was damaged and a section of its library was destroyed by fire. Seismology, a science not directly useful to the prosecution of the war, lost valuable ground. In December 1943, when a severe earthquake shook the area between Aichi and Wakayama prefectures, the routine seismological check-ups could not be conducted because of the deterioration of instruments and the lack of competent personnel. Geology also suffered, though not for the same reasons: since 1937 there had been a gradual exodus of trained geologists to the conquered areas of eastern and southeastern Asia to make surveys and studies of mineral resources. The suspension of the compilation of pre-Meiji scientific source materials, a project begun during the war under the auspices of the Imperial Academy, was a severe blow to students of the history of Japanese science.

Early in the postwar period, however, the urgency of effecting industrial recovery began to stimulate a revival of the work of Japanese scientists. The IPCR, which had partially lost its identity, began afresh as the Science Institute headed by Yoshio Nishina. Under the joint supervision of former nuclear physicists and its own staff chemists, the institute initiated, and took the lead in, the production of penicillin. Every field of science and industry saw similar developments; the ivory tower had been destroyed. The problem of cooperation between science and industry seemed to be finding its own solution.

After the war there was considerable reflection and discussion on the role of science in Japan's future. Scientists and technicians clamored for a reorganization of the structure of Japanese science. The result was the creation of the Japan Council of Science in 1948 by an act of the national Diet. Its establishment was preceded by a survey of the state of Japanese science by an advisory group of eminent scientists from the United States, and by a series of studies and deliberations by a committee of 108 Japanese scientists. Through the council the government aimed to democratize science by making its membership of 210 scientists and technicians (30 in each of seven departments, of which four are in the sciences and three in the humanities and social sciences) elective for three-year terms, and by empowering it to advise the government on all matters pertaining to science and to make recommendations for the disbursement of government subsidies for research. In the first election, which was held in December 1948, 35,354 qualified scientists and technicians cast their votes to select 210 council members from among 945 candidates. With the creation of the council, the Imperial Academy was dissolved and replaced by the Japan Academy to serve under the direction of the council. The new academy's function is to accord due recognition through annual prizes to outstanding Japanese scientists by appraising their findings, treatises, and works.

The subject of science education in the schools also received much attention after the war. In the reorganization of the Ministry of Education in 1946 a new Bureau of Scientific Education was created. It was charged with some of the functions of the former Bureau of Vocational Education, but was concerned essentially with scientific education.

The award of a Nobel Prize in 1949 to Hideki Yukawa for his theory of mesons was an outstanding event in postwar Japan. It should be remembered, however, that his research was accomplished before the war under conditions more favorable to science. While postwar conditions were far from ideal for the promotion and development of science, there were nevertheless isolated but significant signs of recovery by 1950. For example, at the 8th International Genetics Conference in Stockholm in 1948, Hitoshi Kihara of Kyoto University, the first Japanese scientist to attend a postwar international scientific meeting, read his paper on the synthetization of bread wheat, a method he had developed after his discovery of one of the basic components of bread wheat in 1944. Also in 1948, the results of experiments and research on as many as 770 subjects were announced at the general meeting of the Japan Chemical Association. On the subject of vitamins, in which the Japanese had made

notable contributions in the past, Kazuo Nakahara of Tokyo University (formerly Tokyo Imperial University) isolated an important factor from the vitamin B group which he named vitamin L. This factor, which controls the mammary secretions of rats and mice, consists of L₁ (anthranilic acid) and L₂ (adenylthiomethylpentose). In the sericultural and agricultural laboratories experiments were being made to improve the cocoon and grain seeds, while the industrial laboratories were concerned with the improvement of textile machines, mining instruments, and other equipment.

In medicine the paramount trend after the war was toward preventive medicine, as was to be expected by the nature of its most urgent problems: malnutrition, public health, and sanitation. In the early months of 1946 epidemics of typhus and smallpox were brought under control with the cooperation of the Allied occupation authorities. There was also a noticeable reduction in the high death rate from tuberculosis, mainly through the intracutaneous administration of BCG (*Bacillus of Calmette and Guérin*) vaccine. Among other studies being made in the clinical laboratories of Japan were ones on the effects of exposure to radioactive rays, on the relation of viruses to cancerous growth, and on the removal of pain through simple operations on minute nerves.

An event which foretold closer cooperation of Japanese and Western scientists was the observation of the annular solar eclipse of May 8-9, 1948, conducted under the joint auspices of the supreme commander for the Allied powers, the American Geographical Society, and the Tokyo Astronomical Society. Another indication of closer international cooperation was the growing number of Japanese scientists going abroad, especially to the United States, for research. It was hoped thereby that scientific research would recover its former position and that Japanese scientists would have opportunities to serve mankind.

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16. THE FINE ARTS. Much of the history of Japanese art is concerned with the importation of foreign art forms and their subsequent development into forms which bear the unmistakable stamp of Japanese characteristics. It is therefore of interest to study the art forms existing in Japan before the first great wave of foreign influence, which came with the introduction of Buddhism in the 6th century A.D.

Most of the objects still extant naturally fall under the heading of applied arts—that is, they are objects made primarily for practical use. They include weapons, pottery, mirrors, horse

trappings, and the like. Those which can be traced with considerable sureness to the ancestors of the present Japanese people (as distinguished from the Ainu aborigines) show in their form and decoration considerable likeness to contemporary foreign objects, mostly Korean and Chinese.

Fortunately, however, for our present purpose (which is concerned only with the fine arts of painting and sculpture) the earliest Japanese sculpture shows little if any trace of outside influence. These sculptures are grave figures (*haniwa*) made of hollow baked clay; they represent not only human beings, but also a variety of animals. They were made to be buried around the tombs of chieftains and other high personages, and therefore the lower halves of many of them were simple cylinders. Nevertheless, they show simplicity and directness in both apprehension and representation. This may be regarded as fundamental. The animal figures, especially, show a sympathy with nature which also seems a general characteristic of Japanese art. No painting of this period has survived. If we may judge by the few pictorial designs found on bronze mirrors and bells (*dōtaku*), it was probably quite primitive.

Suikō (Asuka) Period (c.570-650).¹—Japanese records indicate that the indigenous production of Buddhist images had begun during the 6th century, but these seem to have been for the most part made of wood and none of the very early ones has survived. The oldest extant definitely dated statue which gives a clear idea of the style is a bronze figure of a seated Yakushi (Buddha of Healing) of the year 607. Both this and other figures which date from the first quarter of the 7th century are so like the Wei type of Chinese sculpture that it has been suggested that they were made by Chinese artists. Yet we have documentary proof to the contrary. Shiba Tori, the most famous sculptor of the period, was the son of Shiba Tasuna, an artist recorded as working in 585, and a grandson of Shiba Tattō, who was the original immigrant of the family. Then there is the question of dates. One of Tori's "Wei" statues is dated 623, at which time the Wei style had long been outmoded in China. The probability is very strong that early Japanese artists simply copied the images brought over when Buddhism was introduced. These were indubitably of the then contemporary Wei type.

It should be noted that, although the Wei type is primarily adapted to a stone technique, all the Japanese early work seems to have been either wood or bronze. There is no work in stone, apparently because Japan is of volcanic origin and there was no marble or other fine-grained stone available. Nevertheless much of it is artistically highly admirable, and at least one piece, the so-called Yumedono Kwannon at Hōryūji, near Nara, is rated among the great statues of the world. During the second quarter of the century, apparently with the help of Korean artists, the old style was modified to fit a wood technique, resulting in several marvelous statues—such as the Kudara Kwannon and the Maitreya or Miroku at Chūgūji—which differ considerably from their Chinese prototypes.

¹ The dates given to art periods in this section do not correspond exactly with those of the historical periods of the same name. They are necessarily arbitrary divisions, since uniformity among specialists has not been reached.

The only extant painting of the period, that on the Tamamushi Shrine, is obviously foreign. The well-known portrait of Shōtoku Taishi and his sons, though apparently a later copy, illustrates the contemporary style.

Hakuhō Period (650-710).—This is a transition period. In its early stages native artists were apparently bewildered by a variety of Chinese styles, mainly Sui and early T'ang, which had been brought in from the latter part of Suikō onward. In an attempt to supply the constantly growing needs for Buddhist images, they produced many statues not wholly artistically integrated. In the middle Hakuhō period a very successful synthesis was obtained in such works as the small bronze triad in the Tachibana Shrine (now at Hōryūji), but this style was soon superseded by a new one, that of the middle T'ang.

The government was at this time trying to reform itself along Chinese lines and was looking forward to its first capital, Nara, which itself was being laid out on a Chinese model. In pursuit of this objective it brought over Chinese artists, who, among other things, produced the great Yakushi trinity at the Yakushiji. These magnificent bronzes, well over life size, represent T'ang sculpture at its height, and are particularly important because no large Chinese bronzes of this type have come down to us.

All extant painting of the period is also Chinese in type. The most important examples are the murals on the walls of the Buddha, or Golden, Hall (Kondō) of the Hōryūji. Their exact date is questionable, but it cannot be far from the turn of the 8th century. There seem to have been several artists employed, certainly not all Chinese, but there is no indication that any were natives of Japan.

Nara (Tempyō) Period (710-800).—Conditions in this period, especially during its first 50 years, were especially favorable for Japanese artists. The new capital was filled with temples, and under government direction Buddhism was spreading rapidly throughout the country. Great numbers of Buddhist images were needed, and needed in a hurry. To supplement the works in bronze and wood, new media, such as clay (built up around a wooden framework) and hollow dry lacquer (used especially for large statues to be carried in processions) came into fashion, and in these the native artists soon became masters.

The earliest clay images are almost pure T'ang, and the earliest known hollow dry lacquer was almost surely of Korean workmanship, but from about 730 to 750 a definitely Japanese style developed. It is marked by a tautness, a sense of power held in leash, which has often been compared to that of a coiled steel spring. It is especially evident in images of the more active minor divinities, such as Vajrapāṇi and the so-called Four Guardian Kings, and is so widespread that it must reflect a general ideal of the time. In the quieter divinities, it sometimes takes a form that is extraordinarily reminiscent of the Greek.

There seems to have been comparatively little work in wood, at least in the capital itself, and almost none in bronze. This last was presumably due to the scarcity of copper, enhanced by the determination of the emperors to build one gigantic central image of the Buddha Vairochana (Roshana), which took some 10 years to make and was finally unveiled in 752. This immense seated statue, called the Daibutsu (Great Buddha)

of Nara, had to be cast in sections, as it was some 53 feet high, and its making taxed the resources of the country. It has been so much damaged and repaired that little of the original remains save one knee and part of its lotus pedestal, but it was presumably T'ang in style. The incised engravings of Buddha groups and other figures on the pedestal are definitely T'ang. Japanese adaptations of T'ang are evident, however, on the bas-relief panels of a 15-foot bronze lantern standing outside the temple of the Daibutsu (Tōdaiji).

In 754 the arrival of the Chinese priest Ganjin (Chien-ch'en, d. 763) with many attendants, including sculptors and artisans, brought with it a new style, known as that of the Tōshōdaiji, the temple in which Ganjin was established. This style was marked by a continental massiveness and grandeur which greatly influenced the Japanese but was never thoroughly assimilated by them.

Painting of the period seems to have followed continental models, although it is not fair to judge it solely from the extraordinary collection of objects preserved in the Shōsōin (the repository of the Tōdaiji), as most of these had belonged to the Emperor Shōmu (r. 724-749) and include a disproportionately large number of imported articles. That there was at least some adaptation of foreign styles can be seen, for example, in the well-known late Nara portrait of Kichijōten (Śrī), who resembles a fairy princess in comparison with the ample proportions then in vogue for T'ang female figures.

Early Heian Period (c.800-c.980).—After the foundation of the new capital of Heian (Kyoto) in 794, there was a long period in which art, especially religious art, was rather stagnant. The revenues of the Nara temples were drastically reduced, and the great period of production for them was over. In Kyoto, in the early years of the 9th century, some statues were made which were rather curiously Bourbon and baroque, and the introduction of the esoteric sects (Tendai in 805, and Shingon in 807) demanded images of a new type. In the main, however, there was little native development of Chinese prototypes, and most of the remaining examples seem ponderous and uninspired.

Buddhist statues, now mostly of lacquered wood, often have a sensuous surface, but they tend toward obesity. Many have well-developed rolls of flesh around their waists. In many paintings, too, fatness seems almost an ideal. And it is significant that there is very little difference between the murals in the Daigōji pagoda (951) and those in the Murōji, painted almost exactly 100 years before.

There was apparently some development in secular painting, but none of it remains. Wonderful stories are told of such artists as Kōse Kanaoka (fl. 850-880) and Kudara Kawanari. Artistic criticism, however, was apparently not very highly developed at the time, since one of the tales is that the artist was actually able to sketch a recognizable portrait of a man whose name he did not know. Extant portraits of monks do not differ much in style from the beginning to the end of the period.

Two peculiar developments should be noted. One was an attempt to reproduce (at Katada) the cave sculptures of the continent. Several caves were hollowed out of a mountainside, and many stone statues were made. But the material

was unsuitable. Today the caves are no more than hollow niches, and most of the statues are in ruins. The other development was the production of Shintō statues. The earliest extant (probably about 890) are excellent examples of the cult of obesity, and the portrait of the war god Hachiman in the robes of a Buddhist monk is entirely Buddhist in style.

Later Heian (Fujiwara, c.980-c.1170).—The proper dates for this, as an art period, are debatable. It is probable that a secular art first developed in the confines of the highly cultured court circles, and that this then affected the religious art. It reached its highest expression in the 11th and early 12th centuries, and is marked by an extraordinary delicacy and refinement. Its ideal seems to be that of an otherworldly, unreal fairyland, and it is perhaps noteworthy that it seems to express itself better in two dimensions than in three. Even its best statues, lovely as some of them are, seem somehow reminiscent of paintings.

From the few examples of secular art still extant it can be seen that the characteristically Japanese style of painting known as Yamato-e developed in this period. It is based on color mass and outline and is splendidly exemplified in the illustrations for *The Tale of Genji* (c.1120), attributed to the artist Fujiwara no Takayoshi.

Religious art was greatly influenced by the rise of the Jōdo (Pure Land) or Amida sects, with their comparatively simple tenets. It becomes gentler and more human than in the previous period. Perhaps the most important single example is the Hōōdō (Phoenix Hall) at Uji (1053). Here a large central Amida is surrounded by masses of angels on clouds carved in high relief and set against the walls, while on the inner sides of the great wooden doors are paintings representing the coming of the Buddha and his attendants to the deaths of the nine classes of believers. There is considerable landscape which may be regarded as secular painting; much of it is very charming. This is definitely Yamato-e, uninfluenced by contemporary Chinese painting (Sung), but it is of interest that the wood carving, especially that of the angels and the halos, is extraordinarily like that of the stone carving then being done in Manchuria under the Liao. There is some suggestion of Liao technique in religious painting also, especially in the color and the profuse use of cut gold leaf (*kirigane*) in addition to the painted gold, but there is no doubt that the mass of Fujiwara painting was an indigenous development.

In the latter part of the Fujiwara period art seems to reflect the unsettled conditions of the country. In sculpture inspiration seems to fail, and there are indications of the coming of a new and more robust ideal, as yet imperfectly assimilated. A more active style of painting appeared, exemplified in such magnificent scrolls as those attributed to Toba Sōjō (1053-1140), where emphasis is placed on brushwork and strength of line. But the old ideals were by no means wholly suspended. The epitome of Fujiwara gorgeousness—though not, indeed, of its delicacy—comes in its last days, in the scrolls of the Lotus Sutra made by the Taira family about 1164.

Kamakura (c.1170-1350).—This was a time of robustness, vigor, and concern with mundane affairs. As an art period it extends about 17 years beyond the historical Kamakura period.

In sculpture a realistic, fully three-dimen-

sional style was introduced by Kōkei and further developed by a number of talented successors, chief among them being his son Unkei (d. 1223), Japan's greatest sculptor. His work shows the influence of Nara rather than of Heian, but has an added realism, force, and activity. He is most successful in his carving of human figures and the semihuman guardian divinities, less so in the necessarily more conventional Buddhas. His school continued with only gradually decreasing vigor until about the middle of the 13th century, after which it rapidly declined. Most of the statues made at this time were of wood. The most important bronze was the Great Buddha at Kamakura, some 35 feet high (1252).

In secular painting there was some magnificent portraiture, and a new type of narrative scroll was introduced by Mitsunaga (c.1173). These were practically books, with little or no writing, which told a story in one continuous picture, in fully developed Yamato-e style. The type was soon adopted for religious purposes also, and was produced in great numbers by many excellent artists throughout the period. Conventional book illustrating was of course not abandoned, but it, too, took on new qualities of vigor and realism.

Although there was a certain hang-over of Fujiwara ideals, especially in the capital city of Kyoto, even the more conservative religious painting soon developed new ideals. Amida begins to come to the deathbeds of the faithful not softly, but on great whirling clouds, and new subjects become popular, such as the great Yamagoshi Buddhas rising from behind the mountains, and paintings of the Bodhisattva Monju (Mañjuśrī) crossing the sea bringing wisdom to Japan. Shintō painting, in a rather curious combination of Buddhist and secular styles, also became more common.

The beginnings of a new Chinese (Sung) influence on painting is discernible as early as 1192. It gradually increased but did not become dominant until the Ashikaga period. In general the unrest brought on by the attempts of Kublai Khan to invade Japan did not affect painting as much as they did sculpture, but it, too, gradually lost its vigor. Toward the end both seem to reflect the national weariness with war, to become meticulous and tangled in detail.

Ashikaga (1350-1570).—From the point of view of the history of art the most important happening in the Ashikaga period was an enormous increase in the popularity of Zen Buddhism. The traditional types of Buddhist art were still used by other sects but they became formalized and repetitive. Life went out of them. The traditional secular art was also affected, increasing in quantity, but gradually decreasing in quality.

In sculpture the only advance was a type originated to portray Zen abbots, and the first exponents of a new style of painting were all Zen monks. Many of these monks journeyed to China and brought back with them Chinese paintings, both religious and secular. Zen religious painting was wholly different from the previous types and was not primarily concerned with Buddhas. It might show arhats (*rakan*), or sages, but tried above all else to suggest the unity of all things, animate and inanimate, and it tended to do the suggesting in the simplest possible way. Hence most Zen paintings have little color and much blank space, and many of the finest are simple ink line and wash (*suiboku*).

The preferred Chinese paintings were those of the Sung period, not contemporary, and these were collected not only in monasteries but also by the nobility. The Japanese at first tended to copy these, or at least their type. There were many famous artists of this time painting these "Chinese" pictures (*Kanga*), but unquestionably the greatest was Sesshū (1420-1506). Though inspired by China, he was in no sense a copyist, and he exerted an immense influence on subsequent painting in Japan.

Sesshū had few direct pupils and at his death several secular schools claimed to be his legitimate successors. Of these the most permanent was the Kanō, whose name has come to be almost synonymous with *Kanga*. The first artist of this school was Kanō Masanobu (1434-1530), but its real founder and the artist who gave it its distinguishing Japanese characteristics, was his son Motonobu (1476-1559). Motonobu had married into the Tosa family, the foremost exponents of Yamato-e, his wife being the daughter or, as some say, the granddaughter of Tosa Mitsunobu (1434-1525), the last great Yamato-e painter of the period. He himself sometimes painted in the "Japanese" style. His pictures, even those done in strictly "Chinese" technique, are not primarily religious in feeling, but are rather decorative, the product of an artist reveling in his medium and delighting in the natural scenery of his own country.

Momoyama (1570-c.1630).—This was the age of the warrior barons who had helped to unify Japan under Nobunaga, Hideyoshi, and Ieyasu, and who wished to enjoy the fruits of victory. The art they wanted and obtained reflected their desire for gorgeousness and was often barely saved from vulgarity by its vigor and ebullience. They could turn even the tea ceremony, with its canons of simplicity and refinement, into an occasion for ostentation, and though comparatively few in numbers, they provided work for many artists.

Momoyama was a time when great six-fold screens, often with gold-leaf backgrounds, might be ordered by the hundred pair; in general the objective of Momoyama art was that of sweeping decoration. Black-and-white painting was not neglected, and indeed could often be a most effective foil to the almost overpowering glitter of gold. The Kanō school continued dominant under the leadership of Eitoku (1543-1590) and his adopted son Sanraku (d. 1635), but there was room for other schools as well, such as the Unkoku and the Hasegawa, which claimed to be the artistic heirs of Sesshū, and the newer Soga and Kaihō, which also were developments of "Chinese" painting. In addition, there were, of course, fine artists who belonged to no school, such as Niten (1584-1645) and Shōkadō (1584-1639).

The history of Yamato-e from the end of Ashikaga through Momoyama is very complicated. Its great champion, the Tosa school, had gone into an eclipse, but its spirit had great influence on most of the contemporary schools. The fortunes of Tosa had been bound up with those of the aristocrats of Kyoto, and with the coming of peace it began to revive. This revival started with Tosa Mitsuyoshi (1539-1613) and continued with his successors. One important development of Yamato-e was the work of two outstanding artists, Tawaraya Sōtatsu (d. ?1643) and Honami Kōetsu (1558-1637). Their art was decorative

rather than profound, and their styles were too individual to allow them to found a school. Their work, however, has greatly influenced all Japanese decorative art down to the present day.

Sculpture had a certain renaissance, chiefly as an adjunct to architecture, in *ramma* (ventilation panels) and other decoration. The best-known artist was Hidari Jingorō (1584?-1634), who did much of the wood carving for the Tōshōgū, the famous memorial to Ieyasu at Nikkō.

Foreigners had reached Japan in 1542, and European art was brought in by traders and missionaries. A number of Japanese became fairly skillful in the techniques of oil painting, but most of their work was destroyed in the 17th century anti-Christian persecutions, and had little effect on Japanese art as a whole.

Tokugawa (Edo) Period (1630-1870).—The Momoyama type of art continued with gradually decreasing exuberance up to "gorgeous Genroku" (1688-1703). The shogun encouraged his vassals in nonmilitary spending, and it was a good time for artists. The Kanō school split into three slightly differing branches under Eitoku's grandsons, Tanyū (1602-1674), Naonobu (1607-1650), and Yasunobu (1613-1685). The Tosa school had an outstanding artist in Mitsuoki (1617-1691), and the decorative style of Sōtatsu was revived and extended by Ogata Kōrin (1658-1716).

A new non-Tosa Yamato-e, exemplified by the Sumiyoshi school, depicted scenes of the contemporary life of the people, usually at the orders of the shogun and other feudal lords. This was the forerunner, and may have been the origin, of the Ukiyo-e, a school primarily of, by, and for the common people, but in which a number of artists of samurai origin also played a part. The townspeople of the rapidly growing cities, particularly Edo (Tokyo), were enjoying more and more leisure and liked a pictorial record of their pleasures. As the demand grew, mass production became a necessity, and the work of the artists was printed, first in books and then in separate prints. The pioneer in this field was Hishikawa Moronobu (d. c.1694). About 1695, Torii Kiyonobu (1664-1729) began to make prints of actors, and his family, which had long been connected with the theater, soon became dominant in this field. These prints were in black and white, sometimes colored by hand.

Early in the 18th century the Kanō and Tosa schools declined, at least partially because many of the nobles and samurai, their principal patrons, were in great financial difficulties. They continued, however, to paint in the classical style, with great emphasis on technique, and many of the best subsequent artists were trained in their ateliers. Some of these artists, like Morikage (fl. c.1700) and Watanabe Shikō (1683-1755), developed their own styles but clung to more or less classical subjects; others, like Hanabusa Itchō (1652-1724) and Miyagawa Chōshun (1682-1752), tended to turn to genre.

There were other revolts against tradition, such as the so-called Nagasaki school, inspired by the work of contemporary Chinese artists, but the most important was the development of the *bunjinga* (literary man's painting). This was hardly a school, but rather a movement among poets, mostly of the samurai class, amateurs who drew their inspiration chiefly from Yüan China and placed their emphasis on emotion and spirituality rather than on technique. Its founder is

usually considered to be Gion Nankai (1677–1751). It is the most difficult of all Japanese painting for foreigners to understand, but it has had a great influence in Japan itself. Ukiyo-e printing—the antithesis of *bunjinga*—made considerable technical advances, and with the invention of color printing (about 1741) entered a new phase.

The latter half of the 18th century produced many important artists, chief among them being Maruyama Ōkyo (1733–1795), who started a new realistic school influenced by the works of contemporary Chinese and European artists which he had studied at Nagasaki. An offshoot of the Maruyama school (the Shijō) was founded in Kyoto by Matsumura Goshun (1752–1811), who also had studied under Yosano Buson (1716–1783), one of the finest of the poet-painters. Its combination of realism and spirituality was very popular and had much influence on Japanese painting in the 19th century. The Tosa and Kanō schools, though still alive, were dormant, but the Kōrin type of painting had an excellent exemplar in Sakai Hōitsu (1761–1828), and there were some very fine painters of *bunjinga*. European painting (*yōga*) was also attempted, based mostly on illustrations in books imported from the Netherlands. No great works resulted, but European perspective became more familiar to Japan.

This was the great period for Ukiyo-e color prints. The technique of full-color printing was first employed for calendar prints of 1765, and a succession of great artists designed figure prints. Suzuki Harunobu (1724–1770), Katsukawa Shunshō (1726–1792), Torii Kiyonaga (1752–1815), Kitagawa Utamaro (1754?–1806), Tōshūsai Sharaku (fl. 1794–1795)—they are known in the West as well if not better than in Japan. By 1800, however, the great day of the figure prints was over. After that time most of the work of Utagawa Toyokuni (1769–1825) and his followers shows garish color and confused design. In the 19th century there were two outstanding artists, Hokusai and Hiroshige, but most of their work was landscape, and out of the Ukiyo-e tradition. Katsushika Hokusai (1760–1849) was the great eclectic; Andō Hiroshige (1797–1858) was greatly influenced by the Shijō school, especially in his *kachō* (bird-and-flower designs).

The 19th century produced a welter of different styles, too many to mention in detail. There was a revival of “Japanese” painting (*fukko* Yamato-e); some excellent painters were developed in the Kanō school; the Shijō school continued with gradually decreasing popularity under Matsumura Keibun (1779–1843) and Okamoto Toyohiko (1773–1843) and their followers; Tani Bunchō (1764–1841), in his time considered the greatest painter in Edo, worked in many styles; and of the *bunjinga* painters, many, like Tanomura Chikuden (1777–1835), took their inspiration from China, while others, like Watanabe Kazan (1793–1841), were at least partially influenced by European art. The world of art reflected the confusion and lack of unity then more or less general throughout the country.

Modern Period (Since 1870).—Immediately after the Meiji Restoration there was great enthusiasm for foreign techniques, which were at first copied without complete understanding, and of course many excellent artists such as Shibata Zeshin (1807–1891) continued to paint in the traditional manner. Other outstanding artists

were Kanō Hōgai (1828–1888), Hashimoto Gahō (1835–1908), and Kawabata Gyokushō (1842–1913), all of whom were trained by Kanō masters and later developed their own styles. Hishida Shunsō (1874–1907), an artist of extraordinary promise who unfortunately died young, was somewhat more influenced by the West.

In the mid-20th century the art world was divided between Western- and Japanese-style artists, and at least the beginnings of a fusion were discernible, though it had not progressed to anything like a full synthesis. Most famous among the more modern Japanese-style artists have been Takeuchi Seiho (1865–1944) in Kyoto and Yokoyama Taikan (1868–1958) in Tokyo. It is difficult, and perhaps out of place here, to evaluate the living Western-style artists, especially since a number of the best known in the Occident, like Yasuo Kuniyoshi (1893–1953), received their artistic training outside Japan. It should also be noted that there has been a revival of color printing, some of which is very successful. See also sections on *Architecture*; *Religion*; article on CHINA—14. *Art*.

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17. ARCHITECTURE. All Far Eastern architecture is based on the structural use of wood. The Chinese have exploited this material to achieve an ideal of discipline and clarity. Their grand plans face to the south, and are symmetrical about a central axis. The wooden framework is painted with formal designs in strong colors. Other materials heighten the impression of artifice: brilliantly glazed tile roofs, stone platforms and balustrades. Where the purpose is purely monumental, as in a pagoda, the design may depend entirely on masonry, or metal, or even porcelain. The Japanese, although they have been strongly influenced by the Chinese ideal, have steadfastly kept a preference for opposite effects of irregularity and naturalness. Their deepest instinct has been to make a building at home in its natural environment, and to give it a kind of homeliness for human occupancy. When the instinct has been allowed full expression, this has resulted in an architecture that in farmhouse, mansion, temple, or palace has made an almost exclusive use of vegetable materials left in their natural colors: wood posts and planks, straw matting, bamboo, rice paper. Where tradition or aesthetic preference has outweighed the desire for fireproofing, the roof as well has been covered with thatch or shingles.

The history of Japanese architecture prior to 19th century westernization may be divided into three broad periods corresponding to the degrees in which native preferences have dominated. The first, down to around 600 A.D., was an age of slow advance from the primitive, stimulated toward the end by sporadic contacts with the mainland. The second, covering about three centuries, brought an amalgamation of Japan into the cultural orbit of China, and a resolute attempt to make over

Japanese architecture, like every other side of civilized life, on the Chinese model. The third has been a long backwash, in which the Chinese forms have been assimilated or abandoned, and a truly national style of high sophistication has been developed.

Early Native Architecture (to c.600 A.D.).

—No buildings remain from the first period, but it is possible to gain a fairly clear idea of their characteristics from secondary evidence. The earliest inhabitants of Japan whose way of life can be reconstructed, perhaps the Stone Age ancestors of the historic Ainu, have left in their settlements the traces of pit houses. In plan these are circular or squarish with rounded corners, around 15 feet across; the most pretentious have a rough stone paving around the central hearth. Post holes suggest a tent-shaped roof of thatch. That the ancestors of the Japanese preferred instead a building with a floor raised on posts (uncomfortable in winter, but preferable in humid summer) is attested by a variety of evidence. What seem to be farm dwellings and storehouses are represented in art toward the latter part of this early period, in line relief on bronzes and as three-dimensional pottery miniatures. Plans are now simple oblongs, with an entrance and windows on the long side. The most elaborate dwellings, with their platforms reached by ladders, and steep thatched roofs flaring widely at the gable peak, have a flavor of the Southwest Pacific that has encouraged theories linking the proto-Japanese to the tropics (see section on *The People*).

The look of these early representations recurs in the modern Shintō sanctuaries that more or less faithfully follow an ancient model. Of a half dozen, the most famous are those at Izumo and Ise, the latter having been identically rebuilt (at least in principle) every 20 years since its cult was standardized in 686. The series seems to show a gradual advance in design. The Izumo sanctuary is a big gabled box on a platform, entered from the end to one side of the ridge pillar, and with a pillar at the middle inside. Its form is only a stage beyond the tent-like bamboo shelters still used by harvesters. Intermediate sanctuary types gain formality by shifting the supports so a door may be centered. With the Ise Shrine (which may have taken form in the 3rd century) the building has been turned around so as to be entered at the middle of the long side, like the Chinese or Korean hall type that may have distantly suggested it. The Ise sanctuary shows most fully a complex of details that recur in part in the rest, and that testify to the preservation of primitive building techniques as a mark of holy antiquity. Most noticeable are the 10 heavy billets set crosswise on the ridge (originally to help weigh down the thatch, as may still be seen in back-country farmhouses); and the prolongation of the bargeboards as a fork high above each end of the roof.

In addition, the earliest Japanese histories contain scattered information on palace buildings. In the age of myth the marriage hut of the primal deities Izanami and Izanagi had a central pillar like the Izumo Shrine. In the last centuries of the period, when cultural infiltration from Korea had become a factor, the palaces are described with a new complication of plan, and with new features like towers. Throughout, the palace and the capital around it were lightly built for temporary use, since the death of the ruler would

require (at least in theory) a move to a new site.

Period of Dominant Chinese Influence (c.600–900 A.D.).—The opening of Japan to close contact with the brilliant civilization of T'ang dynasty China brought two new major architectural problems, the Buddhist temple and the formal, permanent palace-and-capital complex. The two varied only in dimensions and details, using almost identical building types and the same sort of symmetrical grand plan, laid out facing the south in enclosed courtyards, approached through monumental gateways. Building now became vastly more expensive, and served as the prime symbol of a new formality imposed on the life of the ruling class. The permanence required, and obtained by the use of stone-faced platforms, tile roofs, and much heavier timbers protected from weathering by paint, has incidentally resulted in the preservation of many buildings from this period, as well as the layout of two capital cities, Nara and Kyoto (then called Heian), and the group plans of a large number of Buddhist monasteries, followed throughout later rebuilding or still traceable on the sites. Most are in Nara or its environs. One monastery complex there, Hōryūji, still retains its major structures of the 7th century.

The Sinophile period of about three centuries, marked by an admiration that sometimes became a desperate race with T'ang achievement, reached its climax about 725–825. Beginning in 794, Kyoto was built as the last and most ambitious of a series of capitals on the Chinese model, with a regular checkerboard of streets and a central avenue leading from the palace compound on axis at the north. The essentials of the design are still visible in modern Kyoto, though human needs ran counter to symmetry in the city's later growth. The 8th century at Nara saw the number and size of Buddhist monasteries increase steadily, to a climax around 750–759 with the building of Tōdaiji: a huge central hall housing a colossal bronze Buddha, at the center of an *enceinte* as spacious as the imperial palace. The nation emerged from this fever almost bankrupt, fearful of the power wielded by the big metropolitan temples, and already half surfeited with Chinese ways. Even at the climax of the imported fashion native taste was still stubborn. Below the top level, building in the old style continued; even the emperor, though he held court in Chinese robes in a T'ang hall of state, preferred living quarters of a more comfortable homeliness. At Kyoto there were no temples as oppressively grand as Tōdaiji; and Chinese influence ebbed there until around 900 a native reaction was unmistakable.

Surviving monuments show a progression from a 7th century style quite out of date by Chinese standards, to a full T'ang modernity reached by 750. Hōryūji derives through Korea from a north Chinese architecture of the 6th century. Its details show an archaic flatness and a liveliness of line that are the architectural counterpart of Northern Wei dynasty Buddhist sculpture. All architecture of Chinese inspiration uses regularly spaced wood columns in the plane of the wall, with some kind of bracketing above each column to support the heavy roof overhang. At Hōryūji this bracketing consists of only a single transverse beam, reaching out to support the purlin running along the eaves, and braced by a planklike corbel in the same plane, cut out with the fluid irregularity of a cloud pattern. In

the plane of the wall, on the other hand, and on the interior, the bracketing unit is quite different. The column, which in the 7th century has a fine entasis, is capped by a simple square capital. Into the top is let a sturdy bracketing arm, which runs out on either side to end in a subtly drawn curve. There are three bearing blocks like small capitals, one at each end of the arm and one at the middle. These carry the beam above, part of the upper wall system, or in the interior the support for a ceiling. In the mature T'ang style followed in the 8th century, the bracketing over the column becomes a complex built out in three dimensions for maximum structural and visual effectiveness. The irrelevant cloud corbel is abandoned; and on the basis of an architectonic unit like the Hōryūji bracketing arm, the complex is constructed in orderly steps outward and sideways. At this stage the only intercolumnar support provided in the wall plane is a simple strut between two beams, or a bifurcated brace that the Japanese call *kaerumata* (frog's legs).

The original 7th century buildings at Hōryūji include: a pagoda; the Buddha Hall or Kondō (literally, Golden Hall); veranda corridors enclosing three sides of the courtyard; and a gateway on axis at the south. All rise from stone platforms and show similar details. Kondō and gateway are two storied (though the upper is not used), with a penthouse roof skirting the first floor and the whole crowned by the roof form called *irimoya*, which rises halfway as a hip and then becomes a gable. The pagoda is made up of five standard stories, square in plan, separated by the same skirting roofs, and diminishing as they rise. At the top is a typical spire, a mast fitted with superimposed metal disks and crowned by an openwork finial. In plan the only real problem is that of the Kondō, to provide a room for images and worship. At Hōryūji the solution is simple. The hall is five bays wide by four deep. Inside is a surrounding aisle under the skirting roof; in the remaining space, three bays by two, the other columns are omitted to make room for a platform, covered with images, and dignified above by a coved ceiling. The stage of development of the Buddha Hall is still so early here that a memory is preserved of ancient worship in India, where the focus of adoration was not an oblong altar with statues but a round stupa mound enclosed by a processional path. Thus the Kondō images face outward in all directions, only the principal Buddhas being oriented toward the south. It was natural in the Far East, however, that Buddhist worship should be modified by a secular ceremonial that insisted on a southward orientation. By the middle of the 8th century the Hokkedō (Lotus Hall) chapel at Tōdaiji has its altar platform closed by a partition at the back, and its images all face to the south.

The group planning of the monastery is seen earliest at Shitenōji (begun in 593), in Osaka. There the main axis enclosed by the courtyard and corridors holds first the gateway; then the pagoda; then the Buddha Hall; and finally, closing the rear, the Lecture Hall (Kōdō). The trend thereafter being toward a gradual reduction of the pagoda to secondary importance, its first demotion is to be removed from the axis. Hōryūji shows a unique variant in placing it and the Kondō to left and right respectively. Under the Chinese code of symmetry, however, a nonaxial element must normally be doubled.

That next stage may still be traced at Yakushiji (718) outside Nara, where a pagoda was set in each front corner of the courtyard. In the extravagant climax at Tōdaiji, the two pagodas were brought outside to balance on east and west, and were given their own small courtyard complexes. See also CHINA—Art.

Development of a National Style (from c.900 A.D.).—The indigenous reaction during the remainder of the period of Kyoto rule, under the Fujiwara clan down to 1184, took several forms. Though there were still large city temples, the greatest influence was exerted from the mountain headquarters of the new esoteric Buddhist sects, Hieizan and Kōyasan. In their surroundings irregularity of grouping and orientation was natural. There was a general drift away from mandarin formality toward greater comfort and intimacy. The mansions that in the Sinophile design called *shinden-zukuri* had been almost as strictly laid out as city temples lost their tight symmetry and began to ramble. Details were increasingly influenced by the instincts that had never entirely been suppressed. The first natural substitution was a wood platform floor in place of the tile or stone pavement. Construction became lighter; the bracketing was simplified. Buildings were often left unpainted, and were shingled more often than tiled. In this way palaces, temples, and mansions gradually took on a common character of domestic informality.

The most notable development in plan was the creation of a different Buddha hall type, under the pressure of new needs. The T'ang formula of altar platform and surrounding aisle had been adapted neither to elaborate ritual nor to a large lay audience. Both of these factors had a much greater importance during the Fujiwara period, particularly because the new esoteric worship insisted that ritual be performed unseen. The solution reached by about 1200 was a much more elaborate plan, with ample room for the laity in front in a spacious forechamber often the full width of the building, the so-called *raidō*. This public area was divided by a partition with doors or grillwork from the chancel beyond. In the latter a large floor area was left for ritual performances. Across the rear would run a shallow platform, with the main images often enclosed in cabinet shrines. Such a building, completed by a service room at the back, might be deeper than it was wide, in marked distinction to Chinese proportions. Where the 8th century hall had been symmetrical on both axes, this would remain so only in a left and right sense.

Under the military regime at Kamakura (1185-1333) two crosscurrents opposed the long ebb of the Chinese ideal. One, seen around Nara in the restoration of old monasteries, was a deliberate attempt to recreate the 8th century. The other, stronger and more widely felt, was a new stream of Chinese influence. Into Kamakura architecture were injected two alien styles from different regions of South China, inaccurately called "Indian" and "Chinese." The first featured a curiously graceless, powerful technique of bracketing, and was in general so unlike the taste of the time that its popularity was brief. Its most impressive surviving monument is the Great South Gate of Tōdaiji. The other, actually the imperial style of the Southern Sung dynasty, was a more complex and delicate version of the T'ang manner. Frankly ingenious in balancing the weights of interior framing by a system of

levers, it was characterized outside by one obvious change. The bracketing complex no longer rose only from the column top, but was repeated once or twice between with only a wall beam as support, thus transforming the under-eaves zone into a kind of continuous half-structural frieze. The "Chinese" style was an importation of the newly popular Zen Buddhist sect, and later kept much of its original purity in Zen monastic building, together with a standard Chinese group plan. Elsewhere both it and the "Indian" style soon lost identity, and in the end merely contributed a few new terms to the growing eclecticism of architectural decoration.

Post-Kamakura architecture has developed the trends already perceptible around 1200, without radical change. A huge popular place of worship of the 18th century, like the main halls of the Honganji in Kyoto, is hardly more than an enlargement of the mature Kamakura design. The whole temple compound will usually show the free placing made respectable by the old mountain monasteries. The principal novelty will be a great richness of sculptural decoration. Development in this last direction reached its extreme in the parvenu splendors of the 17th century Tokugawa tomb shrines at Nikko; while for more sophisticated patrons it provoked a reaction toward the equally exaggerated austerity seen in the rooms used for the cult of ceremonial tea.

The final flowering of Japanese taste has come with the type of house perfected in recent centuries. The building and its garden are drawn closely together by irregular planning and an absence of strict boundaries; sliding screens permit the rooms to be thrown together and interior to merge with exterior. All is light, and finely worked but simple in design; almost every surface is of vegetable origin, in its natural color. The pleasure taken in such an environment is so great that its charm has been borrowed for every other traditional building type. So completely has it satisfied the aesthetic sense that the Japanese have been willing to overlook its vulnerability to the annual problem of cold, and the periodic catastrophes of earthquake and fire.

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18. LANGUAGE. The language spoken by the middle and upper classes in Tokyo is regarded as the standard language of Japan. It is universally taught in the schools, and is understood, even if it is not completely controlled, by most provincial speakers. This standard language has five vowels, with the qualities in *amah*, *machine*, *uhlan*, *beta*, and *note*. The vowels may be lengthened or may be paired in diphthongs. In rapid speech, *i* and *u* tend to disappear when they occur between voiceless consonants. The consonants are: *p*, *b*, *m*, *t* (*ts* before *u*), *d*, *n*, *ñ* (syllabic), *k*, *g* (nasalized when in the middle of a word), *s*, *sh*, *z*, *j*, *ch*, *h* (bilabial *f* when found before *u*; like the German *ch* in *ich* when found before *i* or *y*), *y*, *w*, *r* (flapped), and *v* (found in a few words borrowed from foreign lan-

guages). Consonants may be palatalized—that is, followed by *y*. The consonants *p*, *t*, *k*, *s*, and *n* may be doubled.

The accent is musical: a difference in pitch rather than stress is often distinguished between adjacent syllables of a word. Three levels of pitch are heard: low, middle, and high, with the intervals approximating that between one note on the piano and that which is two above it. Different pitch schemes distinguish words that are otherwise pronounced alike: *saké*, with the first syllable pronounced at low pitch and the second at middle, means "rice wine," whereas *sake*, with the first syllable taking high pitch and the second middle, means "salmon."

Grammatical categories fall into two groups, inflected and uninflected. The first group includes verbs, copulas, adjectives, and suffixes; the second, nouns, adverbs, and particles. There are four conjugations of verbs, two of which consist of one verb only: *kuru* (to come) and *suru* (to do). Two kinds of copula are found: one abrupt in connotation (*da*), and the other polite (*desu*). The forms of the adjective that may terminate a sentence end in *-ai*, *-oi*, *-ui*, or *-ii*. The word order is subject, object (if any), verb; subject, adjective; or subject, predicate noun, copula. Qualifying words and phrases precede the words they qualify. Particles follow the words, phrases, clauses, and sentences they govern. There are various levels of politeness, depending on the relative social standing of the speaker, the person spoken to, and the persons or things spoken of.

The characters used in writing the Japanese language are of three types: the kanji, which are the more complicated characters borrowed from China (see CHINA—Language); the katakana, which are syllabic characters that are angular in shape; and the hiragana, which are syllabic characters that are cursive in shape. The katakana and the hiragana each number 48; there is a one-for-one correspondence between the two types. The kanji are used to express the chief meaningful elements, such as nouns and the basic root ideas of verbs and adjectives. The katakana and hiragana are phonetic and are used to express the categories whose chief function is grammatical—that is, the syllables which comprise the particles and suffixes. In a typical text only kanji and hiragana are used; katakana are employed to represent foreign words borrowed into Japanese. In most texts these characters are arranged in vertical columns and read from top to bottom, right to left. In a few reference works and scientific texts, however, the arrangement is horizontal, as in English, and the characters are read from left to right, top to bottom; this method permits the inclusion of Roman letters, Arabic numerals, mathematical and chemical formulas, and the like. When written with brush or pen, characters may take the following forms: *kaisho*, or angular writing; *gyōsho*, a somewhat cursive form; and *sōsho*, the most abbreviated and cursive form.

The written language of the earliest times probably closely represented the colloquial. By the 9th or 10th century, however, the spoken and written languages began to separate. The spoken form changed rapidly; the written form was much more conservative. Hence, until the end of World War II, most materials intended for adult reading contained sizable numbers of linguistic forms that had long since been lost in speech. An example is the use of *yukan to su*

(to try to go) instead of the colloquial *ikō to suru*. The use of such constructions peculiar to classical grammar, the large number of arbitrary spellings that had developed in the supposedly phonetic kana, and the need of knowing a great many kanji—perhaps 2,000 to 2,500 before fluent reading could be achieved—meant that the load on the reader's memory was particularly burdensome. Various reforms have thus been suggested. These look forward to the colloquialization of the written language, reduction in number of kanji, the use of phonetic spellings in kana in place of the older historical spellings, and greater use of romanization.

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19. LITERATURE. This section traces the development of Japanese fiction, drama, and poetry from their beginnings to the mid-20th century.

Fiction.—The earliest extant Japanese narrative materials are found in the *fudoki*, or provincial records, which were compiled in the early 8th century; and in the chronicle entitled *Kojiki* (*A Record of Ancient Matters*), traditionally dated in the year 712. These texts record with great simplicity the legends and traditions that had been handed down orally from generation to generation. In the *Taketori Monogatari* (*Tale of the Bamboo Weaver*, 9th century) a superlatively beautiful heavenly girl is found between the nodes of a bamboo stem. When she grows up, five suitors seek her hand, and each is sent forth on an impossible quest. The *Utsubo Monogatari* (end of the 10th century) also uses fabulous material. A more realistic approach is taken in the *Ochikubo Monogatari* (written before 999), in which a beautiful girl is harassed by a wicked stepmother. Meanwhile, the *Ise Monogatari* (c.877) and the *Yamato Monogatari* (c.950) reflected the great vogue of poetry, telling a series of amorous incidents, each centered around an example of the tanka, or 31-syllable poem. Anecdotal and poetic materials were also used in the *Tosa Nikki* (*Tosa Diary*), written about 935 by Ki no Tsurayuki; in the diaries of Murasaki Shikibu, Izumi Shikibu, and the author of the *Sarashina Nikki*, all court ladies of the late 10th and early 11th centuries; and in the miscellany entitled *Makura no Sōshi* (*Pillow Book*), written by another court lady, Sei Shōnagon.

The realistic and lyric strands were finally joined, with a heightened sense of psychological and narrative values, in the great story of courtly life, *Genji Monogatari* (*The Tale of Genji*), which was written by Murasaki Shikibu early in the 11th century. *The Tale of Genji* stands at the apex of the fiction of Heian times (784-1184). In this novel is told the early love life of the hero, Prince Genji, his exile to Suma and Akashi, subsequent recall, rise to the highest political offices of the kingdom, and solicitude

over all the women with whom he has been involved. As Genji grows older, and especially after his death, when the scene shifts from the capital at Heian (now Kyoto) to the hamlet of Uji a dozen miles away, the story becomes much more somber.

The tales and diaries of Heian times were for the most part written by women. Using the easily written hiragana (see section on *Language*), and enjoying considerable freedom of observation and experience in a highly literary and artistic atmosphere, the women of the court virtually monopolized the writing of fiction.

Later writers failed to match the special genius of these women. The collection of 10 short stories known as the *Tsutsumi Chūnagon Monogatari* (*Tales of the Middle Councilor of the Embankment*) was probably written between 1050 and 1250, most of the stories dating from the 11th century. They are distinguished by their comic, satiric, and ironic effects. The *Konjaku Monogatari* (*Tales Modern and Ancient*) is a collection of 1,200 stories, many of them having a Buddhist flavor. Another fresh departure was the *rekishi monogatari*, or historical tale, of which the outstanding examples are the *Eiga Monogatari* (*Tales of Glory*) and the *Okagami* (*Great Mirror*), both dating from the end of the 11th century and telling of the pomp and circumstance surrounding the greatest family of Heian times, the Fujiwara, especially as represented by its most eminent member, Michinaga (966-1028).

Literature decayed in the Kamakura age (1185-1333), which was ushered in by civil war between the Taira and Minamoto clans. The warrior on horseback and the fighting monk now took the center of the stage. Literature became sober and depressing, instructive and moralizing. Typical of the age were various polemical essays written by such religious leaders as Nichiren (1222-1282). Of greater literary interest is the *Hōjōki* (*Ten Foot Square Hut*), written in the year 1212 by Kamo no Chōmei (1153-1216), who records his life as a recluse, and the *Tsurezuregusa* (*Idle Jottings*) of Yoshida Kenkō (1283-1350), who gives his impressions of men, writings, and nature, with many nostalgic references to the life of Heian times. In this period the blending of Chinese and Buddhist words with the native vocabulary added a new vigor to the language, and the warring times gave to a new narrative type, the *gunki monogatari*, or war tale, its quality of strength and freshness. The best of these war tales was the *Heike Monogatari* (*Tales of the Heike*), written for the most part in the first two decades of the 13th century. Sentimental, high flown, and extremely rhetorical, these texts were intended, not to be read, but to be heard to the accompaniment of the *biwa*, or four-stringed lute, played by the *biwa hōshi* (*biwa priests*), who roamed the country and held their audiences in rapt attention as they chanted the fall of men in battle, thus in their way helping to crystallize and to idealize the code of the samurai-warrior.

The next great development in narrative writing came in the Tokugawa era (1603-1867). In the 17th century a peaceful rule, greater literacy among the middle and lower classes, the growth of a class of independent and professional writers, the development of the art of printing, and better facilities for transportation helped to spread fiction throughout the country. Edo (now Tokyo), the seat of the shogunate, began to rival

Kyoto and Osaka as a literary and cultural center. The writing was essentially in kana. The first works, reaching as far back as the end of the 14th century, were the *otogisōshi*, or elementary stories intended to amuse the uneducated. These developed into the *kusazōshi* (grass books) of the middle of the 18th century. Moral, romantic, filled with characters, and containing many twists of plot, they took such names as *akahon* (red books), *kibyōshi* (yellow covers), and *gōkan* (bound books), depending on the color and nature of their bindings. Branching out from this development were the *kanazōshi*, or writings in the syllabic script, and the *yomihon*, or reading books, both didactic types depending largely on Buddhist and Chinese ideas. The *yomihon* were distinguished by their use of ghosts and fabulous creatures. Kyokutei Bakin (1767–1848) was the greatest writer of this genre; his most famous work was the *Satomi Hakkenden*.

From about 1680 a worldly-minded genre known as the *ukiyozōshi*, or tales of the floating world, began to achieve great popularity. Ibara Saikaku (1642–1693) was the leading author; with great realism and in plain words he pictured the effect on family life of affairs in the demi-monde. In the 1750's the *sharehon* (wit book) continued the vogue of erotic writing; in this form the plots were for the most part developed by means of conversations. Another development was the *kokkeibon* (comic book), represented by the *Dōchū Hizakurige* (*Shank's Mare over a Road*), a story by Jippensha Ikku (1765–1831) in which two roisters of Edo, Yajirobei and Kitahachi, travel down the Tōkaidō (Eastern Sea Road) to Kyoto and become involved in all manner of comic misadventures. The love affairs of the sons and daughters of the merchant class are told in the *ninjōbon* (books of human feeling).

The lighter fiction of Tokugawa times lingered on into the period after the Meiji Restoration (1868), but with the impact of Western literature various new types began to flourish. Kanagaki Robun (1829–1894) and Yano Ryūkei (1850–1931) took Western political ideas as the themes of their novels. In the 1870's and 1880's the historical novels of the 1st Baron Lytton and the scientific novels of Victor Hugo were translated into Japanese and enjoyed great popularity. A major event in the history of the novel took place in 1885–1886 when Tsubouchi Shōyō (1859–1935) published his famous *Shōsetsu Shinzui* (*Essence of a Novel*). In this work, Shōyō struck a blow against the didacticism of earlier writers like Bakin and demanded clear objectivity in the description of human life. Shōyō's precepts were followed by Hasegawa Shinnosuke (1864–1909), who wrote under the pen name Futabatei Shimei ("Die and be done with you"). Mori Ōgai (1862–1922), a student of Goethe and inclined to follow a more subjective and deductive line of reasoning, also emancipated himself from traditional points of view.

The subsequent history of the novel is marked by the rise of many schools and writers ranging from realism to idealism. An early realist was Ozaki Kōyō (1867–1903). Among his successors were a group of naturalistic writers including Tayama Katai (1871–1930), Masamune Hakucho (1879–1962), and, for a part of his career, Shimazaki Tōson (1872–1943); and such modern realists as Kikuchi Kan (1888–1948), Akutagawa Ryūnosuke (1892–1927), and Yamamoto Yūzō (1887–). Among idealists may be mentioned Kōda

Rohan (1867–1947), Higuchi Ichiyō (1872–1896), Tokutomi Roka (1868–1927), and Kunikida Doppo (1871–1908), the Mita school headed by Mori Ōgai and Nagai Kafū (1879–1959), the Yōyū (leisure) school of Natsume Sōseki (1867–1916), the Shirakaba (white birch) school of Mushanokōji Saneatsu (1885–) and Arishima Takeo (1878–1923), and Tanizaki Jun'ichirō (1886–1965), an extraordinary exponent of art for art's sake. Christianity, proletarianism, and various other ways of thought and life were espoused by many writers.

Drama.—Examples of Japanese religious drama are the *kagura* and *saibara*, both of which date from the early Heian age and are still performed at Shintō shrines. The *kagura* (literally, "pleasing the deities") is a dance or musical performance that in some forms is purely religious and intended to supplicate the gods; in other forms it is partly ritualistic and partly intended for entertainment. The *saibara* (literally, "get-ready-horse music") is a less polished form presented after the *kagura* has been performed.

Early in the 7th century a religious dance using masks arrived from Korea. This was the *gigaku* (skillful music), which was meant both to add dignity to Buddhist ceremonies and to serve as entertainment. The *gigaku* was performed only until the 10th century. In the 8th century a continental form known as *bugaku* (dance music) had reached Japan. This was an elegant mask dance accompanied by many instruments. More methodical and better arranged than the *gigaku*, it is still performed under the name *gagaku* (refined music). Another development connected with Buddhism is the *ennen-no-mai* (dance of longevity), which is recorded from about the year 1000. It first consisted of a shapeless performance of dances and stunts presented by priests. Soon, however, it began to include Chinese verse, Buddhist stories, and Buddhist poems, called *imayō*, which were made up of 8 or 12 lines consisting alternately of 7 and 5 syllables. The *ennen-no-mai* finally developed a chorus and parts in dialogue. It has persisted to the present day.

Popular drama also had religious beginnings in performances involving supplications for success in farming, fishing, and marriage. The *demmai* (paddy field dance) and the *denka* (paddy field song) evolved into the *dengaku* (paddy field music), which was intended partly as a prayer for a plentiful harvest and partly as amusement for the farmers as they went about their planting. Later, acrobatic stunts were added. The *dengaku* lasted until the 19th century under the name of *dengaku no nō* (accomplishment in paddy field music).

In the 9th century a comic dance incorporating folk music was introduced from India by way of China. This importation was the *sangaku*, or scattered music. Performed at Shintō shrines, it was at first a combination of music, antics, and joking. As *sarugaku* (monkey music), it came to include singing and recitation; later it took the name *sarugaku no nō* (accomplishment in monkey music), and finally it became the major ingredient of the *no* (Jap. *nō*) drama. This drama of "accomplishment" took its present shape in the 14th and 15th centuries. It owes its development also to various elements derived from the *ennen-no-mai*: from the singing and dancing known as *shirabyōshi* (literally, "white rhythm"), which took its name from certain professional dancing

girls; and from various dances associated with particular shrines and festivals.

The sarugaku was the source of the type of chanting employed by the *biwa* priests who recited the more stirring portions of the war romances. It also helped to develop the *kyōgen* (crazy words) that became the comic complement of the no drama. The *sarugaku no nō* and the chanting of the *biwa* priests contributed to the eventual development of the *jōruri*, or marionette drama, in the 16th century. The *kyōgen* was a source of the popular dramatic form *kabuki*, whose literal meaning is "eccentricity," "impudence," or "abnormality."

The two major figures associated with the early history of the no drama are Kannami (1333-1384) and Zeami (1363-1444). The latter in particular rejected the lighter elements of the sarugaku, and he is held to be the father of the no. He was the ancestor of the Kanze school (the other major no schools are the Komparu, Hōshō, Kita, and Kongō). Elegant and slow moving, the no appeals primarily to the initiate. In a typical plot a traveling priest is met by a person at the scene of a famous action. As the two talk, the latter suddenly confesses that he is a spirit in disguise and leaves. When he reappears, he is found to be the hero or major figure who has made the place famous. He sings and dances the role he played in life in making the place a historic spot. A prayer by the priest finally sets the spirit to rest, freed at last from the *shūshin* (heart attachment) which had made him return. The elements of the no drama are contrary to realism. Its poetic qualities are enhanced by the dancing and singing of the chorus, and by a kind of aesthetic frenzy that seems to grip both performers and audience.

The *kyōgen*, in contrast, is a comic form depending on unexpected actions in more or less absurd situations. It is given as comic relief in a no program; its satire attacks both foolish masters and ignorant priests.

The *jōruri* has only one real home in Japan, the Osaka theater called the Bunrakuza. The *kabuki*, however, is popular everywhere. It is extravagantly produced and is spectacular to eye and ear. Living actors, all men, take the place of the dolls of the marionette drama, the acting is exaggerated, and the language relatively simple; the chorus and musical accompaniment add to the color and excitement. The plots take four typical forms: the *jidaimono*, or historical drama; the *sewamono*, or domestic drama; the *aragoto*, or rough mime; and the *shosagoto*, or more elegant dramatic dance. A principal motif of the *jidaimono* is loyalty to one's master; the most famous example is the *Chūshingura* (*Treasury of Loyalty*, or *The Forty-seven Rōnin*), which tells of the vengeance of the 47 samurai whose lord had been forced to commit harakiri. The drama in the *sewamono* arises from the fact that a love affair between hero and heroine is opposed by the parents of one of them. The clash between love and filial duty is most frequently resolved by double suicide, the lovers dying in the belief, fostered by Buddhism, that they will meet in the next existence. The acknowledged master writer of both the *kabuki* and *jōruri* is Chikamatsu Monzaemon (1653-1724).

In the 19th century, Kawatake Mokuami (1816-1893) preserved most of the traditions of the *kabuki*. Toward the end of the century the *shinkabuki* (new *kabuki*) attempted to free the

older style from its conventionalized subject matter, style, and acting. This new type was followed in turn by the dramas of the *shimpa* (new school), which took its subjects from daily life, used the spoken language in place of the older literary idiom, allowed for freedom in style of acting, and permitted actresses to appear on the stage. The modern theater was at last born in the first decade of the 20th century. Tsubouchi Shōyō, in his *Shingakugekiron* (*Argument for a New Drama*, 1905), fought against the sensationalism of the older theater and demanded sound characterization and coherent plots. He was soon followed by a naturalistic school, an idealistic school whose principal representatives were Mushanokōji Saneatsu and Arishima Takeo, a neorealist school made up of writers like Kikuchi Kan and Yamamoto Yūzō, a neoromantic school, and others. The result of these divergent trends is that the modern Japanese theatergoer may see a variety of types of drama—no, *kabuki*, *shimpa* plays, and the modern play, in all their forms. In addition, motion pictures have a popular following, especially in the principal cities.

Poetry.—Japanese poetry is characterized by the alternation of lines of 5 and 7 syllables and the terminating of each poem with a final 7-syllable line. The poetic effects depend on the combination of sounds, the musical accents of the words, and the flow of intonation, punctuated by pauses, from line to line, as well as on the handling of the images. The most popular poetic form, found from the earliest times, is the *tanka* (short poem) of 31 syllables, with five lines running 5-7-5-7-7 syllables. Longer than the *tanka* is the *chōka* (long poem), a general name for all poems containing more than five lines. A special form is the *sedōka* (literally, head-turning poem), a six-line poem with the syllables running 5-7-7-5-7-7. One half of a *sedōka*, running 5-7-7, is the *katuta* (half poem). In the 8th century a comic variety of *tanka*, the *haikai-uta*, arose; known as *kyōka* (crazy poem), it has persisted to modern times. A popular diversion of the Kamakura period was the joint composition by many poets of the *renga* (linked poem). Each *renga* was composed by a group of poets alternately contributing lines of 5-7-5 and 7-7 syllables. The first three lines—the initial contribution of the leading poet—began to achieve independent status in the 16th century. Known as the *hokku*, or *haiku*, it is the 17-syllable poem which, next to the *tanka*, is the most popular Japanese poetic form. In the 17th and 18th centuries a comic variety of the 17-syllable poem found its acknowledged master in Senryū (1718-1790), who gave his name to this form.

Japanese poetry is unusually elliptical. Among the special poetic devices is the *makurakotoba* (pillow word), a stock epithet, consisting usually of five syllables, which qualifies particular nouns. *Ashibiki no* (foot-dragging), for example, is applied to mountains. The significance of many pillow words, however, has been lost. The *jo* (introduction) is a long decorative phrase placed before a word; unlike the pillow word, it is not fixed in form, and it may run over many lines. Fortunately it died with the earliest long poems. The *kakekotoba* (pivot word), punningly used both at the end of one phrase and at the beginning of the next, frequently plagued the poetry of the late Heian era and after. An even more pervasive device is the *engo* (associative word), which is used in one part of a poem

with a specific meaning, but carries overtones of a second or third meaning because of its common association with words used in other parts of the poem.

The earliest poetry, still preserved in the chronicles of the 8th century, possesses the exuberant quality of speech. The earliest anthology is the *Man'yōshū* (*Collection of Ten Thousand Leaves*), compiled mainly in and after the year 759. Consisting of 20 scrolls and 4,516 poems which were written by poets in all walks of life, from emperors to farmers and guardsmen in the provinces, the *Man'yōshū* achieved early lyrical heights. Its spirit is characterized by great freshness, simplicity, and directness. The *Man'yōshū* poet was optimistic; he rejoiced in the colors and scents of nature and enjoyed the present moment. His favorite theme was love, but he also wrote many elegies, poems expressing homesickness, and nature poems, as well as poems of a humorous and even derisive cast; poems with a patriotic coloration; buoyant banqueting, drinking, and hunting songs; and poems inspired by various legends. The finest poets of the *Man'yōshū* are Kakinomoto no Hitomaro (662-c.710), a court poet best remembered for his lengthy elegies; Yamabe no Akahito (d. c.736), a superlative nature poet; Yamanoe no Okura (660-733), a Confucianist; and Ōtomo no Tabito (664-731), a poet known for the depth of his human sympathies.

The second great anthology was the *Kokinshū* (*Collection Ancient and Modern*, c.922). Its principal compiler was Ki no Tsurayuki (d. 946). Like the *Man'yōshū*, this collection is divided into 20 scrolls. The total number of poems, however, is only 1,111. Whereas the *Man'yōshū* contains 262 *nagauta* and 61 *sedōka*, the *Kokinshū* includes only 5 of the former and 4 of the latter. The tanka has thus become the predominant form. Of the 20 scrolls, 6 are devoted to nature poetry, and 5 to love poetry. There is a considerable loss in vigor. The poet is more reflective and pessimistic, more Buddhistic. In addition to Tsurayuki, who provided a preface which is the earliest extended treatise on native poetry, the priest Henjō (815-890), Ariwara no Narihira (825-880), and Ono no Komachi (d. c.890) are the leading poets.

The *Kokinshū* was the first of 21 anthologies whose compilation was decreed by various emperors. The last in the series was compiled in 1438. Each collection consists of 20 scrolls; the average number of poems is 1,600. Of all the 20 collections which followed the *Kokinshū*, however, only the *Shinkokinshū* (*New Collection Ancient and Modern*, 1205) achieved a degree of poetic excellence. The *Shin'yōshū* (*Collection of New Leaves*, 1381), was a private collection and not compiled by imperial command. It, too, contained poetry of excellent quality. A few major poets like the priest Saigyō (1118-1190) and Fujiwara no Toshinari (1114-1204) appeared, but the old flair was gone; poetry became the property of masters who professed to know its secrets but were completely obsessed by rules; the subjects became conventionalized, and, as in the case of the *renga*, poetry became a pastime rather than an art.

Signs of revival in the tanka form came in the 17th century, when the first great scholars of earlier literature began to imitate the poetry of Nara and Heian times. Toda Mosui (1629-1706), the priest Keichū (1640-1701), and

Shimokawabe Chōryū (1624-1686) imitated, not too consciously, the poetry of the *Kokinshū* and *Shinkokinshū*. Kamo Mabuchi (1697-1769), on the other hand, deliberately went back to the *Man'yōshū*. Motoori Norinaga (1730-1801) favored the style of the *Shinkokinshū*. Others, like Tachibana Chikage (1735-1808) and Kawagawa Kageki (1768-1843), imitated the *Kokinshū*.

The greatest poets of the time wrote *haiku*. The finest writer in this medium was Matsuo Bashō (1644-1694), who recorded impressionistically and thoughtfully his reactions to nature. Gentle and wise, he gathered a host of disciples. Taniguchi or Yosano Buson (1716-1783) was a painter-poet. His *haiku* dealt realistically with human affairs as well as with nature. Kobayashi Issa (1763-1827) is known for his humanity and pathetic quality. A sarcastic strain is found in some of his poems, but his sympathy for living things extended even to the fleas that infested his cottage.

The tanka and the *haiku* retained their popularity in modern times. A few of the tanka poets, notably those connected with the Outadokoro (Imperial Palace Poetry Bureau), worked along traditional lines. But the greater majority tried to renovate the tanka, joining various schools and publishing their poems in the magazines supported by these schools. The Asakasha (light fragrance school) was founded by Ochiai Naobumi (1861-1903), who was rooted in the classics but is also known for his romantic tone. Among his followers were Yosano Tekkan (1873-1935), known for his masculine vigor, Onoe Shibafune (1876-1957), known for his intellectual skepticism, and Sasaki Nobutsuna (1872-1963), known for his easy and graceful style and for his reflective nature poetry. Yosano Tekkan soon dissented from this group. Seeking for poetry the right to describe human life in all its emotional turmoil, seeking, moreover, the right to use a wide-ranging vocabulary, he headed the naturalists of the Shinshisha (new poetry school). In the magazine *Myōjō*, founded in 1900, he produced poetry of extreme emotionalism, glorifying love. Belonging to his school were his wife Akiko (1878-1942); Ishikawa Takuboku (1885-1912), in his earlier work; and Horiguchi Daigaku (1892-). A reaction set in with the Negishi school, founded by Masaoka Shiki (1867-1902) and named for the section in Tokyo in which he lived. Shiki was a superlative poet who preached reserve and decorum, realism and objectivity. He took the rhythms of the poetry of the *Man'yōshū* for his model; his leading followers are Shimaki Akahiko (1876-1925), Saitō Mokichi (1882-1953), Itō Sachio (1864-1913), and Nagatsuka Takashi (1879-1915). Their work is found in the newspaper *Nihon* and in the magazines *Ashibi* (1903-1908), *Akane* (1908-1909), *Araragi* (1908-), and *Nikkō* (1924-1927).

The *haiku*, too, had its adherents who were unable to strike out along original lines. Imitating Bashō and Issa, men like Setchūan Jakushi (1848-1908) were known as "masters of the commonplace." It was Masaoka Shiki who preached the renovation of the *haiku* as he did of the tanka. He called upon each poet to control his emotions, which were to be suggested rather than openly displayed. Using Buson as his model, Shiki strove for a sober and concrete notation. Shiki's principles were not completely accepted. Some felt that his emphasis on sobriety and

technique could lead only to the impoverishment of the *haiku*; they therefore espoused complete liberty of theme and technique. Also opposed to Shiki were certain poets who were academic in their leanings and tended to rely on studious research rather than on a creative spirit. Shiki's principles gained widespread acceptance with the publication of the journal *Hototogisu* (1897–), first edited by him and then by Takahama Kyoshi (1874–1959), but the Shinkeikō (new tendencies school), which was led by one of Shiki's former disciples, Kawahigashi Hekigodō (1873–1936), claimed for the *haiku* the suppression of all traditional ideas, even of the 5-7-5 line scheme, and other writers also claimed independence from Shiki's tenets.

One of the most important developments in the field of poetry came with the revival of the long poem. In the 1880's the first translations into Japanese of Occidental, especially of English, poetry suggested the creation of a poetic form of unlimited length. The resulting *shintai-shi* (new-form poetry) appeared in the collection known as the *Shintaishishō* (1882), which was fathered by three men: Toyama Shōichi (1848–1900), Yatabe Ryōkichi (1852–1899), and Inoue Tetsujirō (1855–1944). Fourteen of the works in this collection were translations from English, American, and French poetry, but five were original. The alternation of lines of 7 and 5 syllables reverses the usual 5-7 alternation; other poems were written with each of the lines containing 5 syllables or 7, and alternations of 8-6 and 7-4 syllables were also attempted. Each of the three translators provided a preface. Both by precept and by example the three men called for freedom in the choice of poetic subjects; in length, form, and scope; in the use of the modern colloquial idiom; and in the adoption of foreign models. The *Shintaishika* (1882) and *Shintai-shisen* (1886) followed shortly thereafter. The last dozen years of the 19th century were a period of great activity, with the poets aligning themselves in such groups as the Bungakukai (Literary Club), the Kokumin no Tomo (Friends of the People), the Akamonha (Red Gate School, consisting mainly of poets connected with Tokyo Imperial University), and the Wasedaha (composed of poets connected with Waseda University). Other schools rose with the dawn of the 20th century, so that the picture from about 1920 on is one of great confusion, with Whitmanesque, sentimental, symbolist, impressionist, and other schools vying with each other, and with the composition of popular poetry and of children's songs in form longer than the tanka.

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20. HISTORY: FROM THE EARLIEST TIMES TO 1853. This section discusses the history of Japan to the final and permanent opening of the country to Occidental influence in 1853 by Commodore Matthew C. Perry (q.v.).

Prehistoric Japan.—Little is known for certain about the origins of the Japanese people. No Paleolithic remains have been discovered but there is good evidence to show that in prehistoric times the country was peopled by immigrants from several parts of eastern Asia, mostly of Tungusic origin, but some from southern regions. Neolithic remains show that prior to these migrations Japan was sparsely inhabited by ancestors of the people now known as Ainu, who are thought to be of proto-Caucasic origin. By the beginning of the Christian era the later immigrants had reached a fair degree of ethnic fusion and had acquired from China and Korea the rudiments of a metal culture. The Ainu were gradually pushed northward. See also section on *The People*.

Early History to About 400 A.D.—Archaeological evidence and Chinese records provide a picture of Japan in the first four or five centuries of our era. It shows a number of tribal communities competing with one another for influence or military strength. Those native chieftains who made the best use of new techniques acquired from Korean teachers were able in the course of time to outstrip their rivals; and before

long certain tribes or clans had achieved over others a measure of dominance which by the beginning of the 5th century had brought a group known as the Yamato people to a position of supremacy in central Japan. In the eventual recognition of the leader of one clan as the sovereign of the Yamato people we see the beginnings of the tradition of imperial rule in Japan. But despite the obedience nominally due to the head of the imperial clan the other clans claimed such a virtual independence that the history of Japan for many succeeding centuries is a record, on the one hand, of attempts by powerful clan leaders to supersede or to dominate the imperial clan and, on the other hand, of efforts by the imperial clan to form a centralized, monarchical state. Unity was not easy to achieve, since each separate clan was a self-contained patriarchal unit, composed of households of the same ancestry, all under the leadership of a hereditary chieftain. Its members tended to place loyalty to clan before the common interest of all clans, for family feeling was strong and it was reinforced by the worship of a tutelary deity, from whom the leader of the clan claimed descent.

A trend toward cohesion among the clans, however, was created by the need for unity in war, especially in campaigns on the Korean peninsula. There had been close and constant intercourse between western Japan and Korea since the 1st century A.D., and by the end of the 4th century Japanese armies were taking part in struggles between Korean kingdoms. These kingdoms were under strong Chinese influence, and by about 400 A.D., the Japanese, learning from Korean tutors, began to use the Chinese script. This was a turning point in the history of Japan, since it enabled the Japanese to adopt important features of Chinese culture which depended upon written documents.

Adoption of Buddhism.—Probably the most important borrowing to follow the adoption of a script was the introduction (about 552) of Buddhism, which was flourishing in China at that time and lately had been accepted in Korea. Besides being a strong civilizing influence, fostering the arts and promoting both religious and secular learning, Buddhism hastened political development by intensifying the conflict between conservative forces, which stood for the old tribal institutions, and progressive forces working for a centralized government. A struggle for power between contending clans turned upon the question of religion, and in 587, after a short and bloody civil war, the party which favored Buddhism gained the upper hand. When the reigning emperor had been murdered, the Empress Suikō was recognized in his place, in 593. During most of her reign, which lasted to 628, affairs of state were conducted by a regent, Crown Prince Shōtoku (d. 621 or 622), one of the greater figures in Japanese history. He promoted the cause of Buddhism and worked hard for political reform. In 604 he issued his "constitution" of 17 articles, a set of moral injunctions addressed to the clans. These contain a new view of the state, for they dwell upon duties as well as rights and enunciate clearly the ideal of a centralized state in which the great nobles exercise authority as servants of the throne. But the power of the emperor was not yet so firmly established as his prestige; and it was not until 646 that a further necessary step was taken by the issue of the Taikwa (Great Reform) edict, which introduced

a new system of central and local government, land tenure, and taxation designed to deprive the clans of their autonomy. Throughout the 7th century Japanese envoys, monks, and scholars visited China and returned with impressive accounts of that country under the Sui and T'ang dynasties. The fact that reforms were based on their reports enhanced in Japan the prestige of all branches of Chinese learning.

The Nara Period (710-784).—By 710 the first permanent capital of Japan was built at Nara, a beautiful city on the model of the Chinese capital at Changan (Sian), with palaces, official mansions, great monasteries, and pagodas filled with treasures of sacred art. (See sections on *The Fine Arts*; *Architecture*.) Here the emperors reigned and exercised a growing authority, though already one of the great clans, the Fujiwara, had made itself a power behind the throne. In the capital the arts and learning flourished as never before. Religion flourished too; the Buddhist church grew to such heights of influence as to threaten secular authority. It was largely to escape this danger that the court was moved from Nara to Nagaoka in 784, and then to a new capital, on the site of the modern Kyoto, in 794.

The Heian Period (784-1184).—This period takes its name from that of the new capital, which was called Heian-jō (Citadel of Peace). In these four centuries a new Japanese culture was formed by the incorporation of Korean and Chinese elements into Japanese life. After Japanese tradition had begun to reassert itself, the resultant product was something Chinese in form but Japanese in essence. As Buddhism grew in strength, a certain reaction in favor of the indigenous cult made itself felt. This cult was a simple pantheism, in which an essence of divinity was perceived in all natural objects as well as in the tribal ancestors. Japan was thought to have been founded by the Sun Goddess, Amaterasu-ōmikami, and the emperors were regarded as her descendants, while other clans traced their ancestry to other *kami*, or gods. The nature religion, called Shintō (the way of the gods) to distinguish it from *Butsudō* (the way of the buddhas), was the expression of deeply rooted sentiments. By the end of the Nara period a compromise had been found by regarding both gods and buddhas as manifestations of one truth. (See section on *Religion*.) This characteristic fusion of native and borrowed elements is exhibited in the institutional history of the Heian period. At the height of Chinese influence administrative systems closely following Chinese models had been introduced in the Taihō Code of 702 and the Yōrō Code of 757. But since the schematic methods of the Chinese did not suit Japanese tradition and temperament, the organs of central and provincial government gradually came under the control of the leading clans. The carefully devised systems of land tenure and taxation were weakened by the fiscal immunities which great nobles and monasteries acquired. Thus during the Heian period the institutions created by the Taikwa reforms were so changed in character that they retained only their names and little of their original substance. The clan spirit—the native tradition—had reasserted itself.

A similar trend is visible in literature and the arts. At first the native language was contemned, but Japanese poetry and prose came into

fashion by 1000, and such works as the famous *Genji Monogatari* (*The Tale of Genji*) represent the high-water mark of pure Japanese literature. Religious developments also, particularly toward the close of the Heian period, testify to a growing national pride and to a desire to stamp with a Japanese imprint the foreign doctrines which hitherto had dominated intellectual life. This is particularly true of the sects devoted to the worship of Amida, which, arising from a need for simple doctrine to replace the abstruse teaching of the older sects, had acquired by the end of the Heian period a distinctive Japanese character; and it is true in varying degree of all subsequent versions of Buddhism in Japan.

The last, and perhaps the most important departure from the Chinese pattern, is visible in the political history of the late Heian era. Strife between factions for the control of the emperor, beginning with palace intrigues, broadened into civil war, in which first the Fujiwara lost their power and then the two great clans of Taira and Minamoto clashed until they met in a decisive struggle. The Chinese system of government collapsed, and the ancient rivalry of the clans was resumed. Both Taira and Minamoto were clans composed of fighting men who had established themselves in the provinces, acquiring and holding their land by armed strength. In the course of the 12th century they formed a class of warriors owing allegiance to their clan leaders rather than to the throne, and by 1185, after the final defeat of the Taira, the Minamoto house was supreme in Japan. Its chieftain Yoritomo (1147-1199) established his headquarters—the Bakufu (seat of military government)—at Kamakura, so as to be remote from court influence and to live among his important vassals, who were established in eastern Japan. Here began the final phase of Japanese history, which in one form or another lasted until 1868.

The Kamakura Period (1185-1333).—By the defeat of his enemies Yoritomo acquired in most parts of Japan great estates, which he distributed among his supporters as a reward for services in battle. In the course of his campaigns he had obtained from the emperor a commission to chastise the "rebels" and eventually was nominated (1192) Sei-i Tai-Shōgun (barbarian-quelling generalissimo), a title which first had been conferred upon the leader of an expedition against the Ainu in 794 and which gave its holder the command of all military forces in the empire. Like all his successors in this office, Yoritomo did not pretend to sovereign powers. He always observed forms of reverence to the emperor; and he was flattered by the grant of high court rank. He was careful to obtain the reluctant consent of the court to the appointment of constables and stewards throughout Japan. Yoritomo himself became constable general and steward general of the realm, thus gaining control of police affairs in each province and power to levy taxes upon all cultivated land, whether in public or private domains.

The creation of these new offices was the first phase in a long process by which the old bureaucratic system was replaced by an organized feudalism. To bring it to perfection time was needed. The first half century or more of the Kamakura regime was devoted to legislation devised to strengthen the ties of allegiance between the Minamoto house and its vassals by dispensing justice in disputes as to their rights

and duties and by creating a strong feudal hierarchy dependent upon a rigid code of loyalty. It was in this period that the code of military virtue—*Bushidō* (the way of the warrior)—became a coherent doctrine, embodied in the oaths and charters which defined the relationships between overlord and vassal, landowner and tenant, master and man. Among the fundamental documents of Japanese feudalism is the *Jōei Shikimoku* (*Formulary of Jōei*) of 1232, a set of rules and maxims which embodied the results of half a century's working of the feudal system. This was not presented as a national law, but only as the house law of the Minamoto family to be observed by its vassals. In effect, however, it displaced the old Taihō and Yōrō codes and in substance became the common law of Japan.

For nearly a century after 1185 the Kamakura regime continued peaceful and stable. After Yoritomo's death the Kamakura government was carefully administered by regents of the family of Hōjō Tokimasa (1138-1215), Yoritomo's father-in-law and one of his trusted allies. The Hōjō controlled the shogun just as Fujiwara nobles had controlled the emperors. But signs of discontent among the landed gentry were already visible in the early history of the Kamakura shogunate. The amount of land available was not enough to satisfy their growing families and the court was always ready to plot with disaffected feudal lords against the Bakufu. In 1274 the Mongol emperor of China, Kublai Khan, sent a great expedition to invade Japan. This was repulsed, as was a second attack in 1281; but the cost of defensive measures and the strain upon the resources of the vassals who had borne the burden of the attack were so great that the Bakufu, itself in financial straits, could not recompense its own supporters. Its authority diminished, and by 1333, under color of disputes as to succession to the throne, the capture and destruction of Kamakura brought the Hōjō regency to an end.

A new emperor, Daigo II (Go-Daigo, r. 1318-1339), occupied the throne and Kyoto was once more the seat of government. But he depended upon the support of a feudal lord named Ashikaga Takauji (1305-1358), who was made shogun in 1338. The Ashikaga family, after some 50 years of dynastic struggles, gained the upper hand over their feudal rivals and enjoyed a checkered and uneasy supremacy until about 1500, when sporadic feudal conflicts merged into a civil war which spread over the entire country.

Ashikaga Shogunate (1338-1573).—This period may be briefly dismissed as one of civil war, in which the remnants of the centralized rule exercised by the early Kamakura shoguns were discarded, and power was divided among a number of great barons over whom the Ashikaga shoguns held only a shadowy authority. Warfare was almost continuous, yet in the 14th and 15th centuries progress was made in many fields of endeavor. The movement of troops and supplies about the country improved communications and developed domestic trade; the shifting of allegiances, the collapse of old institutions, the use of new men dissolved the rigidity of the old social order and brought about a violent rearrangement of classes. It was an age of turmoil and of destruction, but not of decay.

Perhaps its most remarkable feature was the progress of the arts. The upstart feudal leaders used their newly gained wealth to patronize

artists and men of letters. Two of the Ashikaga shoguns in particular—Yoshimitsu (r. 1367–1395) and Yoshimasa (r. 1447–1474)—are celebrated as leaders of aesthetic coteries which displayed a great connoisseurship in the arts and developed an aesthetic tradition which has been a strong influence in Japanese life. (See section on *The Fine Arts*.)

It should be added that in this age there was close contact between Japan and China which, besides bringing to Japan many valuable examples of Chinese art, enlarged trade between the two countries. Ventures were undertaken by the shoguns, by great monasteries, and by feudal magnates, especially those in coastal provinces. There were also frequent voyages, many of which were piratical, to the Philippines, Indonesia, Siam, and Malacca. Japanese maritime enterprise grew steadily, and Japanese traders or adventurers were familiar with most Far Eastern ports by the end of the 15th century. The chief ports, notably Sakai, gained considerable autonomy and resembled in some ways the free cities of medieval Europe. What might have led to a great expansion of foreign trade and to the growth of a politically influential mercantile class was interrupted, however, by the course of political events at home, for by the year 1500 fighting between contending feudal powers, hitherto intermittent and local, had spread over all Japan.

The Warring Provinces.—The 16th century brought the final struggle for the redistribution of feudal power. Fierce, widespread, and protracted as it was, it must be regarded as a progress toward unity and order. Three great men were the successive architects of the centralized state which was to emerge in the 17th century.

The first was Oda Nobunaga (1534–1582), a small landholder who by skillful strategy was able to consolidate a strong position in the central provinces, to occupy the capital, and by 1568 to become the *de facto* shogun, though the Ashikaga were titular shoguns until 1597. Thereafter he, with his two celebrated lieutenants, Hashiba (later Toyotomi) Hideyoshi (1536–1598) and Tokugawa Ieyasu (1542–1616), set about subduing hostile barons east and west of the territory which he held. By 1582, when Nobunaga was murdered, they had between them overcome most of their enemies, who included not only feudal lords but also powerful Buddhist sects, whose monasteries had great military strength. It was in the extreme west of Japan, in the island of Kyushu, and across the straits on the mainland that some of his most stubborn rivals had their domains. To these regions there came about 1542 the first Europeans to see Japan—a few Portuguese, driven to shore in the province of Satsuma by stress of weather. They soon were followed by other Portuguese—traders and then Jesuit missionaries under the leadership of St. Francis Xavier.

Christian evangelization in Japan had a remarkable success, which was due largely to the untiring devotion of the Jesuit fathers. They were favored by contemporary political conditions, for the feudal barons soon perceived that Portuguese traders would come where missionaries were well treated and that the traders could furnish them with arms, ammunition, and other supplies, which would increase their military strength and give them commercial profit. Most of these rulers therefore treated the Jesuits well,

and some went so far as to order the people in their domains to accept the Christian faith. Moreover, many genuine conversions occurred, since the missionaries offered both spiritual and material comforts to the common people, whose condition in those times of civil war was wretched. Within 20 years of Xavier's arrival they had succeeded in making converts among the upper classes in central Japan, and in 1568 they were received by Nobunaga, who showed them some favors. His patronage, which owed something to his hatred of the insubordinate Buddhist sects, was of such value to them that by 1582 they claimed 150,000 converts.

Nobunaga was succeeded by Hideyoshi, who with Ieyasu's military aid continued the work of unification. Hideyoshi was now master of more than half of the Japanese provinces. He next reduced to such submission those great barons who still opposed him that by 1590 Japan was at peace for the first time in more than a century. Hideyoshi was a great man whose ambition was unbounded. Since he was of humble origin and could not aspire to the title of shogun, he was appointed to the ancient office of *kwambaku* (regent) and was in effect the ruler of the land. During his lifetime Hideyoshi laid the foundation of the new feudal edifice which was to be erected by his successor, Ieyasu. He put an end to the relatively free movement between classes which had developed under the Ashikaga shoguns (and to which he himself had owed his rise) by decreeing in 1586 that every man should remain in his own calling, whether peasant or tradesman or soldier. In 1587 he confiscated all weapons in the hands of peasants, thus emphasizing the distinction between the military caste and all others and making the sword a badge of rank. In general Hideyoshi legislated to preserve the balanced system of feudal power which he had erected. All his undertakings—his fortresses, his palaces, his entertainments—were on a grand scale. The Momoyama period (named after his palace at Momoyama in Kyoto, built in 1594) is distinguished for bold design and lavish execution, which reflect a certain heroic quality in the society of his day.

Hideyoshi treated the foreign missionaries well for some years. For a long time he had planned a war against China and he thought that the Portuguese might supply him with ships and guns. Although some of his ablest generals were converts to Christianity, Hideyoshi presently began to suspect that the missionaries were forerunners of armed aggression by Spain or Portugal and in 1587 without warning he issued an edict banishing them from Japan. This was not seriously enforced until after his expedition against China, which took the form of an invasion of Korea in 1592. After some preliminary successes this venture failed and the Japanese withdrew before a large Chinese army in 1593. A second attempt, made in 1597, was inconclusive and was abandoned on the death of Hideyoshi in 1598. It was in 1597 that persecution of Christians began at the order of Hideyoshi, who by then had judged from the behavior of Spanish Franciscans that Spain had designs upon Japan. Even so, after the first outburst, the anti-Christian edicts were not strictly enforced and the missionaries continued their work. By 1600 the number of converts had reached 300,000 and promised further increase.

Tokugawa Shogunate (1603-1867).—Ieyasu followed Hideyoshi in 1598, making his capital at Edo (Yedo), the modern Tokyo. His family, named Tokugawa, was of Minamoto descent. He was appointed shogun in 1603, after he had defeated at the Battle of Sekigahara (1600) a hostile combination of feudal lords who, though subdued by Hideyoshi, had never been reconciled to his supremacy. Ieyasu then redistributed the fiefs to ensure against further rebellion and by 1615 he disposed of the last of his enemies. Ieyasu died in June 1616, but he had already won for the Tokugawa family a dominance over Japan which was to last for more than 250 years.

Ieyasu at first showed no animosity toward the missionaries. He planned to encourage the growth of Japan's merchant marine and the expansion of her foreign trade. He went so far as to offer open ports in eastern Japan to Spanish vessels, and he made it clear that he would not enforce the anti-Christian edicts. But before long, growing suspicious of Christians in general and Spaniards in particular, he sought other channels of foreign trade. Having learned of the enmity between Catholic and Protestant states, Ieyasu gave trading privileges to the Dutch and the English and he began to turn against the Jesuits and the Franciscans. Some perfunctory bans against them were issued by him as early as 1606, but in 1615 severe persecution commenced. It was directed mainly against Japanese converts, and during Ieyasu's lifetime no foreigner was executed.

After his death his son Hidetada, the second shogun (r. 1616-1623), continued his father's policy of building a system of checks and balances which would make it difficult for the unreconciled barons to rebel against the shogunate. Since he saw that this system might collapse if those barons, some of whom favored Christianity, could obtain arms and ships and perhaps military aid from the foreigners, Hidetada accordingly ordered all foreign priests without exception to leave the country and ruthlessly persecuted all Japanese Christians. In 1624 under Iemitsu, the third shogun (r. 1623-1651), all Spaniards were deported. In 1637 a rebellion, in which Japanese Christians were implicated, began at Shimabara in western Japan, but was savagely repressed in 1638. Thereafter all Japanese were forbidden to travel abroad, all Portuguese were expelled, and other foreigners (Dutch and Chinese) were confined to a small area in Nagasaki where (and nowhere else) a very limited foreign trade was permitted. By 1640 Japan was virtually isolated from the outside world and Christianity was eradicated.

In this seclusion the Tokugawa rulers endeavored to fix society in one unchangeable pattern. They established in their own domains a strict official hierarchy and, though they left a measure of autonomy to the great feudal lords, they kept them under close watch, intervening when they thought it necessary. All vassals were obliged to subscribe to an oath of allegiance renewed with each change of shogun, and all were compelled to attend regularly at the shogun's court, leaving their families in Edo as hostages when they returned to their fiefs. The duties, privileges, and emoluments of each grade of the military class were minutely regulated, from the daimyō (daimio, or great feudal lord) down to the simple samurai (soldier). Below these ranked the farmer, the artisan, the mer-

chant, and, last of all, the outcasts, actors, butchers, and other workers in defiling trades; and legally it was not possible to move from one class to another.

These conditions persisted for a century or more after 1600. There were peace and order and firm, if harsh, government. The growth of great cities, like Edo and Osaka, and of a number of castle towns led to an increased demand for commodities and to the development of a more complex urban life than had been known. The townspeople developed a lively society of their own, which was devoted to good living and fostered popular arts: the theater, the novel, and the color print. Population continued to increase, reaching perhaps 29 million in the first quarter of the 18th century, but thereafter remained stationary, pressing upon the limits of subsistence and occasionally diminishing as a result of famine or pestilence, which occurred at frequent intervals until well into the 19th century. These economic disasters combined with other causes to weaken the system of government, which the Tokugawa rulers had endeavored to preserve unchanged. Contradictions inherent in that system were revealed with the passage of years. It proved increasingly difficult to maintain the prestige of a military class which was superfluous in time of peace, for the duties of most of the samurai were little more than nominal and their emoluments were a drain upon the national economy. Not only had the growth of urban life brought into prominence a class of merchants and bankers who thrived at the expense of their feudal masters, but also the penetration of a money economy tended to destroy the rice economy upon which the feudal system was based. To bolster its public finance the Bakufu resorted to depreciation of the coinage and forced loans, policies which in the long run increased the distress of the samurai. The peasants were overtaxed and agrarian risings were frequent. The merchants resented the levies by the authorities and their interference with trade. The intellectuals chafed under the restraints of orthodoxy.

Under Yoshimune, the eighth shogun (r. 1716-1745), these disruptive tendencies were checked for a while by measures of economy. Yoshimune relaxed the interdicts on Western learning which were part of the anti-Christian policy of the Bakufu, thereby unwittingly encouraging studies which led to discontent. Scholars began to learn Dutch and so to gain some knowledge of Western science. Samurai with active minds began to resent the strict class system, which denied them full use of their abilities, and to question the official school of Confucianism. Economists, dismayed by recurring famines and wild fluctuations in price, began to suspect that there was some fundamental weakness in the Tokugawa government. From this it was a short step to questioning the legitimacy of Tokugawa rule. All these currents of subversive thought were swollen toward the end of the 18th century by the arrival of Russian and American vessels off the shores of Japan. The Bakufu refused their requests for trading facilities and reissued the decrees against the entry of foreign vessels. An American vessel, the *Morrison*, was repulsed by gunfire in 1837. But foreign vessels continued to arrive, and the Bakufu, financially embarrassed and aware of the superior military strength of the Western powers, began to doubt whether the policy of se-

clusion could be maintained. In the clans and even among Bakufu officials there was a growing opinion in favor of opening the country, based on the conviction that Japan was weak and might renew her strength by the application of Western scientific methods to her military and economic problems. The Bakufu vacillated for a time and refused an invitation to open trade relations carried by United States warships in 1846. But when in 1853 Commodore Matthew C. Perry with a strong squadron arrived in Tokyo Bay and repeated the invitation, saying that he would come for an answer next year, it was clear that there could be no refusal.

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21. DEVELOPMENT OF THE MODERN STATE (1850-1945). This section traces Japan's evolution from the decline of the Tokugawa shogunate, through the restoration of imperial authority and the adoption of Western institutions, to the totalitarian state of the mid-20th century.

Formation of a Constitutional Monarchy, 1850-1890.—Since 1850, Japan has undergone a complete cycle in its history. Both internal and external forces during the turbulent years of the mid-19th century resulted in the overthrow of the military dictatorship of the Tokugawa family, which had effectively forced its policies on the country for 250 years. New forms of a modern state, a centralized government, with a new constitution, universal education, a conscript army, modern systems of communications and transportation under governmental ownership, and a modern industrialized economy were substituted for basically feudal institutions and customs. A strong, closely knit empire slowly evolved to include the rich island of Formosa in the south and the Kwantung Leased Territory, the South Manchurian Railway zone, and the Korean peninsula on the Asiatic continent. Through conquest and the establishment of puppet governments direct Japanese control extended from the southern frontiers of the Asiatic continent to Kamchatka in the north. After the invasion of Manchuria in 1931, this new empire again fell into the hands of a military dictatorship, not of a single individual or of a single family but of an elite and powerful group of leaders from the army and navy supported by civilian industrialists and politicians. By Sept. 1, 1945, Japan had been completely defeated, its military machine smashed, its economy thoroughly dislocated and temporarily reduced to impotency, and its emperor and government made subservient to the authority of Gen. Douglas MacArthur as supreme commander for the Allied powers. Finally, its territory was reduced to that of the mid-19th century: the four main home islands of Hokkaido, Honshu, Shikoku, and Kyushu, and innumerable smaller islands lying within the traditional territorial waters of Japan.

In 1850 the traditional policy and strict enforcement of exclusion of Japan from the outside world, except for a few Dutch and Chinese traders, the continued concentration of political

power in the hands of a small group of warriors, the stratification of society, the inability to inaugurate basic economic reforms which would relieve the peasantry of the onerous task of being the main productive class, and the weaknesses inherent in a military dictatorship were ample cause for the collapse of the central government. Added to these factors were the requests of the Western powers (especially the Netherlands, the United States, and Russia), with their superior technical knowledge and their higher standard of living, that Japan sign treaties of peace and friendship. Nowhere is the inherent weakness of the Tokugawa government better revealed than by its action in 1853 following the demand of the United States, delivered by Commodore Matthew C. Perry and supported by a strong naval squadron which was to return the next year, that Japan be opened to American trade and that foreigners be allowed to reside there. The military dictator—the Tokugawa shogun (then Ieyoshi, succeeded that year by Iesada)—was unwilling and unable to decide the question alone and sought the opinion of all the feudal barons (daimyō), his allies and enemies alike. As less than a third of the barons opposed the American demands, as the Russians were simultaneously pressing for a treaty of peace and friendship, as Japan was impotent militarily and wished to avoid the semi-colonial status which the Western powers had forced on China, the first foreign treaty was signed with the United States at Kanagawa in 1854.

Many of the young warriors of this period had been influenced by nationalist scholars whose studies clearly showed that the real ruler of Japan should be the emperor. Those who lived in western Japan in the feudal domains of Satsuma, Choshu, Tosa, and Hizen (usually referred to collectively as Satcho Dohi) were particularly sensitive to such teachings, because their masters, though kept in unwilling obedience, had been the traditional enemies of the Tokugawa rulers. These men, who were to be the real leaders of the new Japan, had been exposed to the even more drastic teachings of nationalists such as Shoin Yoshida and Sanai Hashimoto. The former advocated military preparedness not only to expel the foreigners, but also to permit Japanese colonization of the surrounding islands and of Korea, Manchuria, and Formosa. The latter proposed a military alliance with Russia to safeguard Japan's position. Furthermore, such industrialization as then existed in Japan was largely concentrated in those same western domains of Satcho Dohi. Small iron foundries, reverberatory furnaces for the manufacture of guns, industries making silk, paper, sugar, glazed porcelain, and other products, and even the construction of a small steamboat gave the future national leaders the training which they needed for modernizing Japan.

The presence of the foreigners as a result of the treaties with the Western powers irked the nationalist-minded and arrogant Satcho Dohi warriors. They increased the antiforeign sentiment in Japan by their attack on the consulates and on individual foreigners without fear of retaliation from the tottering Tokugawa dictatorship. The foreigners refused to be intimidated, however, and undertook the chastisement of the culprits by naval bombardments of their fiefs. Finally, in 1867, combining the rapidly growing movement for the "expulsion of the foreign

barbarians (Americans and Europeans)" with that of the "veneration of the emperor," the Satcho Dohi warriors allied themselves with the emperor and forced the capitulation of the Tokugawa dictatorship. Emperor Mutsuhito (better known by his reign name of Meiji) was restored in 1868 as the actual ruler of Japan; minor military resistance to the Meiji Restoration, as it was called, was soon suppressed.

The first task of the new leaders was the abolition of the outward vestiges of feudalism and the establishment of a central government deriving its power from the emperor. Consequently they persuaded the feudal barons to surrender to the emperor the titles to their fiefs and to ask him to issue such decrees as were necessary to place the lands and people of the four Satcho Dohi clans directly under his authority. After many other feudal barons had followed their example, all the fiefs were formally abolished in 1871. In the next few years the support of the feudal barons and the warriors, whose annual income heretofore had been measured in terms of rice, was assured for the new government by the liquidation of their rice incomes, which were converted into government bonds. Meanwhile, the new government sent technical missions abroad to study European technology and institutions. Universal conscription and a modern army and navy, a uniform national tax on the value, not the produce, of the land, a national currency, railroads, the telegraph, a postal system, public utilities, universal education, and similar accoutrements of a modern state were inaugurated. The government either constructed at its own expense or subsidized those heavy industries necessary to develop a modern army and navy. The chief positions in the central government were filled by a few persons who formed a closely knit oligarchy that rotated from one position to another. Thus Gen. Prince Aritomo Yamagata first organized the army while war minister and then became home minister and premier (1889–1891; 1898); and Prince Hirobumi Ito first concentrated on finances and public works, then supervised the drafting of the constitution, and was premier four times in the period 1885–1901.

When the practical problems confronting the new state had largely been solved, the next big problem confronting the oligarchs was the formation of a constitutional government which would preserve the rights and powers of the emperor as an absolute monarch and also would satisfy the people's ever-increasing demands for a representative legislature. The prestige of the government and of the ruling oligarchs had been greatly enhanced by their ability to suppress a movement for the annexation of Korea and to substitute for it a relatively minor expedition against the Formosan aborigines. Furthermore, the new conscript army subjugated the formidable revolt of Takamori Saigo and his followers in southern Kyushu in 1877.

Ito, the leader of the conservative oligarchs, advocated a constitutional monarchy with absolute powers. The greatest challenge to this concept came from the leaders of two new political factions: the Liberals and the Reformers (Progressives). They urged a parliamentary form of government with a maximum of power concentrated in the hands of the people's elected representatives. This threat to autocratic control was met by the emperor's promise to establish a parliament by 1890, by the promulgation of

stringent laws to control the press and public meetings, and by the dispatch of a mission abroad under Ito's leadership to study foreign forms of government. He found the Prussian Constitution the best model to follow for the preservation of the throne's special characteristics and powers. Consequently Ito prevented public interference with his plans by drafting the constitution under the protection of the emperor through the Imperial Household Ministry. As president of the Privy Council, the highest body of advisers to the throne, he obtained approval for a constitution which placed absolute power in the emperor. It was promulgated to the people on Feb. 11, 1889. Furthermore, General Yamagata, who was minister of home affairs during this critical period, freely used the national police to suppress any signs of opposition by the people.

Henceforth, under the provisions of the constitution, which was never amended and was replaced only in 1947, the emperor was virtually the state. The military could circumvent the Cabinet by appealing directly to the throne, but the political parties in the lower house of Parliament could not insist on the premier being selected from the majority party, since Parliament did not have full budgetary powers and because individual liberties were greatly restricted. See also section on *Government*.

Emergence of Japan as a Modern Power (1890–1920).—With the completion of a political structure which assured the continued ascendancy of the clan oligarchs who had shaped the constitutional monarchy, the first 30 years of parliamentary government saw a vain attempt on the part of the representatives of the political parties in the lower house of the Diet to win control. The prime minister was chosen invariably from among the leaders of the Satsuma or Choshu (Satcho) clans and any obstreperous move by Parliament was countered by proroguing or adjourning it. Japan's position in the Korean peninsula, which had been steadily strengthened by intrigues with the opposing political factions within Korea, was challenged in 1894 by China, which refused to relinquish its long dominance over Korean affairs, and the oligarchs at home found the opposition to their rule rapidly increasing in Parliament. Furthermore, the military leaders were anxious to test the strength of their new army, and a new spirit of nationalism was engendered by a chauvinistic press and by an educational system which emphasized the subservience of the individual to the good of the state. As a result of the Sino-Japanese War of 1894–1895, Japan not only replaced China in the control of Korean internal affairs, but also secured the first of its overseas territories, the island of Formosa, and exacted from China an indemnity to cover most of the expenses of the war, which had been fought outside Japan.

Nationalism was stimulated further by Japan's experience with power politics as practiced by European states. China had awarded the Liaotung Peninsula to Japan at the Treaty of Shimonoseki in 1895. Fearful lest Japan usurp its position on the Asiatic continent, Russia persuaded France and Germany to join it in forcing Japan to relinquish this territory. After this bitter experience the nation as a whole was convinced that its new position as a world power could be maintained and strengthened only by the development of an armament sufficiently powerful to challenge any potential or real enemy or group of enemies.

It likewise saw the Western powers acquire leaseholds and military bases in China, and the United States develop into a colonial power through the acquisition of the Hawaiian Islands and the Philippines in 1898.

No objection was raised by the political parties to these wars. Moreover, no one challenged the assignment of a military officer as governor of Formosa or the fact that regulations were promulgated to restrict to the highest-ranking generals and admirals on the active list those eligible to serve as ministers of war or navy. This ordinance, which was rescinded only to be reissued, gave the military actual control over the Cabinet. When any Cabinet refused to obey their wishes, the military could order their representatives in the Cabinet to resign, thus causing its downfall. Likewise they could prevent formation of a Cabinet when the premier designate was unacceptable to them. Thus, when Prince Ito had formed a powerful political party, which gave him strong support in the lower house of Parliament, General Yamagata, who was the leader of the military group, feared that his powers might be checked. In 1901, after forcing Ito to resign as premier, Yamagata maneuvered the appointment of one of his protégés, Prince Taro Katsura, as the next prime minister. Even though Ito's party (the Seiyukai) won a majority in the next election (1903), Ito did not return to power.

This impotency on the part of Parliament and its lack of interest in opposing expansionism and Japanese designs on Korea led inevitably to the Russo-Japanese War (1904-1905). As in the previous conflict, the fighting was outside Japan. Southern Sakhalin (Karafuto) became an integral part of the empire and Japan replaced Russia in Manchuria. Meanwhile, through the Anglo-Japanese Alliance (1902), Japan had obtained an ally in the West. Through the formal annexation of Korea (1910), Japan secured its flank from attack, added roughly one third to both the area and the population of the empire, and acquired a colony with great economic potentialities.

Economically, the years following the Sino-Japanese War were a period of encouragement and growth of industry as a whole. The war indemnity reduced the need for foreign borrowing and made capital available for investment in new industries. Markets were extended and a general capitalistic expansion increased the concentration of wealth in the hands of a small privileged class. After 1905 domestic products were protected by tariffs and Japanese industries stood on an equal footing with their foreign rivals. Strategic industries were expanded, as evidenced by the growth of the Japan Steel Works and 35 other factories manufacturing arms, and all the important railroads were nationalized. Consumer goods, particularly textiles, appeared on the foreign market, so that the new industrial structure with its resultant products for export was to become a cause rather than an effect of war.

World War I afforded Japan another unique opportunity to increase its position as a world power. Militarily, Japan defeated the German forces in the Shantung Peninsula in China, and in the Pacific islands north of the equator. Politically, Japan assured confirmation of these conquests in the Treaty of Versailles through secret agreements with European powers. Despite the fact that the prime minister, Marquis

Shigenobu Okuma, had been the leader of the movement for a representative form of government, Japan consolidated its special economic and political position in China through the Twenty-one Demands in 1915 and later strengthened its strategic position by sending an expedition to Soviet Siberia. Economically, the war likewise provided Japan with an unprecedented opportunity. Its limited military responsibilities permitted the concentration of national energies on industrial production and expansion. During the war years new markets were acquired in Asia, Africa, Australia, and the South Seas. The production of silk trebled; the number of workers in factories employing over five persons doubled to more than 2,000,000. A prewar unfavorable trade balance was rapidly eradicated and Japan emerged from the war with a net credit on its international account of approximately 3,000,000,000 yen.

Rise of Nationalism and Defeat (1920-1945).—Immediately following World War I, Japan entered a period during which it was to have at least a minimum of experience with party governments. The first commoner to become prime minister, Takashi Hara, president of the Seiyukai, had come into power in 1918 on a wave of popular discontent with the high cost of living and of general disapproval of the oligarchs' policies. In the first postwar election his party received an absolute majority in the House of Representatives (283 seats to 176), and he confidently announced that militarism had been defeated.

Internationally, Japan appeared to have abandoned its aggressive intentions. It welcomed membership in the League of Nations. At the Washington Conference (1921-1922) it agreed to cancel the Anglo-Japanese Alliance, to withdraw from Shantung, to abandon its occupation of Siberia and northern Sakhalin, and to reduce its naval armaments. It acquiesced in the principles of no further fortifications in the Pacific and of equal opportunity in and respect for the territorial integrity of China.

Yet normal parliamentary government was to be hampered greatly by one of the most important, but unpredictable, characteristics of modern Japan—direct action by recalcitrant and disgruntled elements. Premier Hara was murdered on Nov. 4, 1921 by a railway employee who hoped by his action to attract attention to the corruption and degeneracy of the government leaders. His death was the signal for disintegration within the Seiyukai, so that the Cabinet was forced to resign in June 1922. The conservative advisers to the emperor disregarded the leaders of the political parties and selected the next three premiers from among the military. Simultaneously the Japanese were shocked by the passage of the Immigration Act of 1924, which excluded Orientals from the United States. A temporary collapse of the silk market and the overvaluation of the yen caused the rapid exhaustion of Japan's foreign credit accumulated during the war. Unrest among labor groups, "dangerous thought" among the students, and the fear of the results of universal manhood suffrage resulted in the passage of the Peace Preservation Law of 1925, which gave the police wide powers. Violent outbreaks in the lower house were commonplace; opportunism, not political principles, guided its members in their voting. Each of the two largest business combines allied themselves with one of the leading political parties.

Such was the generally unstable atmosphere existing in 1924, when the Seiyukai and the Minseito, the two principal parties, took turns in running the government for the next eight years. Even during this period only two premiers had a majority in the lower house. Premier Yuko Hamaguchi (1929-1931) obtained an absolute majority for his party (the Minseito) in the elections of February 1930. He openly challenged the military by insisting that the London Naval Treaty (1930) be ratified despite strenuous opposition from the Navy General Staff. Unfortunately for him and for liberalism in Japan, however, he came to power just when the world depression struck Japan. The loss of the silk market in the United States, the shrinkage of other foreign trade, and the government's policy of retrenchment and of return to the gold standard intensified the situation and created an atmosphere favorable to the growth of ultranationalism.

The cry of the militarists that Japan's economic ills could be cured only by direct action in China and by the exploitation of Manchuria fell on sympathetic ears. The wounding of Hamaguchi a few months later greatly simplified the task of the military in regaining control from the political parties. The constitutional provisions which gave them direct access to the throne and the lack of any provision for joint Cabinet responsibility to the Diet strengthened their position. Furthermore, developments in China played into their hands. Japan's monopoly of railway traffic in Manchuria through the Japanese-owned South Manchurian Railway was threatened by a complicated network of new Chinese lines. The Japanese guards along the zone of the railroad claimed that they were threatened constantly by Chinese bandits and that Japanese agents had been killed in the hinterland. Chinese unification was extending north of the Great Wall to such a degree that Chang Hsueh-liang, the Manchurian war lord, refused to make local agreements with the Japanese. Plans were carefully made and a simulated bombing of the South Manchurian Railway on Sept. 18, 1931 was the signal for the rapid and effective occupation of Manchuria by the Japanese Army. The organizers of this policy of direct action came to be known as the Manchurian clique in the army. Thus began the period of dual diplomacy: the Foreign Office placating the Western powers by statements which disclaimed any aggressive intentions of Japan in Asia; the military, largely guided by the Manchurian clique, slowly expanding their control through intrigue and by military campaigns.

The second prime minister during this short period of party governments to obtain an overwhelming majority in the Diet was Ki Tsuyoshi Inukai (1931-1932). His party (the Seiyukai) won the elections of February 1932, but the army already controlled Manchuria. Direct action at home also had its effects on the parties. In the same month Junnosuke Inouye, the campaign manager of the opposition party (the Minseito), was murdered by members of an ultranationalist group. Three months later Prime Minister Inukai was assassinated in an abortive coup d'état by another group determined to destroy the existing political parties, which it labeled as the enemies of the nation. His was the last party Cabinet, and Parliament became increasingly impotent and unwilling to check the spread of

militarism. In 1940 the political parties voted themselves out of existence and were replaced by the government-sponsored Imperial Rule Assistance Association, which assured the election of only those supporting national policy.

Moreover, whenever there was the slightest threat to the control by the military, direct action at home effectively eliminated the opposition or further expansion abroad placed Japan in an international position from which it became increasingly difficult to withdraw. The most violent of all the attempted coups d'état in those years occurred in February 1936. The ultranationalists had just received a thorough defeat at the polls. A moderate element within the army had attempted to remove some of the Manchurian clique from key positions. A group of young army extremists, aided by some of their superiors, decided that the time had come to seize the government by force. The result of this uprising was the murder of three senior statesmen who had opposed ultranationalist policies, and the wounding of others. Furthermore, the emperor's personal advisers and any other leaders holding moderate views realized that their lives were in danger if they opposed the extremists.

Meanwhile, the army and navy leaders lost no opportunity to convert all elements within Japan to their cause. They bombarded the conscript troops from the impoverished rural areas with pamphlets which extolled patriotism and sacrifice for the state and which insisted that Japan was destined to bring order and peace to the continent of Asia. It was argued that Japan must protect herself from within against the enemies of communism and capitalism by developing a powerful nationalistic government and must prepare for attack from without by relentlessly perfecting her military machine. The educational system was geared to this new concept of nationalism; the history texts concentrated on the divine origin of the emperor and of the empire; courses in "ethics" taught that the highest life for the Japanese subject was one in which he offered himself in perfect loyalty to the throne; teachers and professors who deviated from this line were summarily dismissed. Already in existence were laws which made it easy to control recalcitrant writers or any subversive elements. The government-owned radio also lent its aid. The labor movement, which never had been strong in Japan before World War II, became a willing supporter of the nationalist program. Agrarian unrest, which had been increasing during the depression years, was checked by promises that the expansion in Manchuria and in China would solve the problem of rural indebtedness and by the placing of local government officials in charge of farmers' cooperatives. In view of Japan's military tradition and heritage, it was comparatively easy to condition the people for a totalitarian state.

Several obstacles, however, still prevented the immediate formation of a completely totalitarian military state. First, the Manchurian clique lacked practical experience in organizing and operating a military state and were not yet in complete control of the army. Second, they had not convinced the conservative financial and industrial leaders (*zaibatsu*), that they would profit from expansion. Finally, the bureaucrats were still trying to sabotage the plans of the extremists.

The puppet government of Manchukuo (first

organized in 1932) gave the new leaders an opportunity to apply their most radical concepts of state control of industry. Here was a testing ground for a planned wartime economy, where they developed a plan for the expansion of strategic industries under governmental supervision and control and for the formation of semiofficial companies. The economy of Manchukuo was closely linked with the overall Japanese armament program. Its success contributed not only to the growth of a new group of industrialists dedicated to ultranationalism, but also to the prestige of the Manchurian clique within the army. Consequently the architects of Manchukuo later became the planners of Japan's wartime structure. Such opposition to the expansionists as had existed among the *zaibatsu* was silenced by the profits which they were making from the enormous expansion of heavy industries and from the insatiable demands of the army and navy for more goods. Furthermore, the *zaibatsu* saw their special position challenged by the new industrialists who had invested in Manchuria and in north China, and by the huge government-sponsored development corporations for each of the conquered areas. Consequently many of them accepted appointments to the nationalist Cabinets as ministers of finance, ministers of commerce and industry, or governors of the Bank of Japan. The managers of their leading subsidiaries were made presidents of the new control associations in their respective industries. Another potential source of danger to military rule had capitulated. Finally, the jurisdiction over all affairs on the Asiatic continent was wrested from the Foreign Office and was placed under the direct control of the military. Even the bureaucrats were powerless to object effectively to expansionism. Thus it was possible for Japan to develop into a military state within the framework of the constitution during the decade before Pearl Harbor. Elections were held, prime ministers were appointed by the emperor's advisers, and Parliament continued in session, but the dictatorship which finally emerged under Gen. Hideki Tojo as premier was complete.

On the international front the military leaders did not have matters so completely under control. They had underestimated the difficulty of conquering China, but used that as the excuse for the passage of the National Mobilization Law (1938). In the hope that a close alliance would develop between Japan and China, a Chinese puppet government was inaugurated (1940). To bolster this movement both at home and abroad, the prime minister expounded on the virtues of a new order for East Asia and a Greater East Asia Co-Prosperity Sphere under the aegis of Japan. After the outbreak of World War II in 1939, Germany and Italy put constant pressure on Japan to join the Axis. On the other hand, Germany and Soviet Russia had signed a nonaggression pact and Japan was reluctant to take any steps which would involve her in a war against the Soviet Union, especially after the sobering experiences of the battles on the Korean and Mongolian borders. Moreover, the subjugation of China was not complete and the new puppet regime at Nanking was not winning the support of influential Chinese. In July 1939, the United States had given six months' notice of its intention to abrogate its commercial treaty with Japan, which was a clear indication that it expected to embargo the shipment of war materials, including oil. To the army's desire

to expand on the continent of Asia was added the navy's compulsion to conquer the rich oil-fields in Southeast Asia.

It was no surprise, therefore, that Japan capitalized on the downfall of France by obtaining privileges in French Indochina from the Vichy government and by establishing military and air bases there (September 1940). In the Tripartite Pact concluded in the same month with Germany and Italy, Japan obtained from her Axis partners recognition of the new order in Greater East Asia under Japanese leadership and the promise of assistance in the event of war with the United States. Despite these developments, Japan still hoped for the impossible—namely, the capitulation of Generalissimo Chiang Kai-shek, the continued neutrality of the United States, and the promotion of economic cooperation between Japan and the United States. Consequently the ubiquitous Yosuke Matsuoka, who had led the Japanese delegation out of the League of Nations, had been president of the South Manchurian Railway Company and a staunch supporter of an aggressive policy in Asia, and had become foreign minister, attempted the unbelievable task of maintaining the Tripartite Pact and of reaching a settlement with China, the United States, and the Soviet Union. Friendly relations with the Soviet Union, which had been exemplified by the Soviet-Japanese Non-aggression Pact of April 1941, were strained by Germany's attack on Russian two months later.

Negotiations between Japan and the United States were begun, but it was soon clear that Japan was unwilling to abandon its expansionist policy. As the American proposals, which were based on the principle of respect for the territorial integrity of other states, were counter to all the basic moves taken by the Japanese military leaders since the invasion of Manchuria, it was impossible for them to reverse their position and still to remain in power. When an attempt by Prime Minister Prince Fumimaro Konoye to arrange a meeting with President Franklin D. Roosevelt in the summer of 1941 had failed, the final phase of the struggle within Japan between the military extremists and the moderates for the control of Japan's destinies was reached. On Oct. 18, 1941, Gen. Hideki Tojo became prime minister and appointed to his Cabinet those men who favored a totalitarian military state. Japan again had fallen under the complete domination of a military dictatorship. Plans already made for war against the Allies were then put into effect.

In less than two months Pearl Harbor and Manila were attacked and the United States entered the war against the Axis. Through unbelievably speedy military advances in the entire Pacific, the rapid amalgamation of the industries and resources of the conquered territories into Japan's war economy, and the complete control of the government over all phases of life at home, Japan threw the Allies off balance. But Japan could not withstand the slow, yet steady, pressure exerted against it on the sea and in the air by the Allies, principally by the United States, and finally agreed to accept the Allied terms in August 1945. When the Japanese representatives signed the Instrument of Surrender on the U.S.S. *Missouri* on Sept. 2, 1945, Japan admitted complete defeat, promised to abide by whatever orders Gen. Douglas MacArthur, the supreme commander for the Allied powers, might issue, and agreed to the dismemberment of its empire and to the return to its boundaries of a century earlier. See also

section on *Foreign Relations (1931-1945)*; CHINA—8. *History*; KOREA—12. *History*; WORLD WAR II—2. *Between World Wars*; biographies of major figures.

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22. FOREIGN RELATIONS (1931-1945).

—In 1931, Japan came to an irrevocable turning point in foreign policy. Late in 1929 the New York silk market had collapsed, bringing acute distress to the Japanese countryside, which depended heavily upon cocoons as a cash crop. The military leaders became concerned lest the economic crisis cause disaffection in the army, whose composition and outlook were largely agrarian. The situation also presented them with an opportunity to gain a political dominance which they long had sought and to discredit the civilian moderates, during whose brief ascendancy Japan had subscribed, in the treaties concluded at the Washington Conference (1921-1922) and the London Naval Conference (1930), to policies of self-restraint toward China and to limiting naval armaments. Military propagandists denounced the parliamentary parties and big business for allegedly exploiting the masses and betraying national interests, assailed the United States for discriminatory treatment of Japanese and for erecting tariff walls against Japanese manufactured goods, declared that Japan as a have-not nation must expand in order to survive, and proposed a program of social and economic reconstruction, of reactionary nationalism, and of a strong and independent foreign policy. The ascendancy attained by the army in the government was the key to Japan's international relations during the following decade.

Conquest of Manchuria.—In Manchuria stifening Chinese resistance to further Japanese penetration led to incidents and an accumulation of unsettled cases. Japanese military extremists agitated to have the army take the Manchuria question out of the hands of the Foreign Office. On Sept. 18, 1931 elements in the Kwantung Army (as the Japanese garrisons in Manchuria were designated), using a manufactured incident near Mukden (Shenyang) as a pretext, struck suddenly and proceeded to overrun and to subjugate southern Manchuria and some months later the entire territory. Popular feeling against Japan rose throughout China as a result of this so-called Mukden incident. In Shanghai a boycott against Japanese goods and a clash between Chinese and Japanese residents in January 1932 became enlarged until more than three Japanese army divisions and 3,000 marines were fighting the Chinese Nineteenth Route Army. In pursuance of a truce reached on May 5 through the intercession of the United States and other powers, the Chinese forces retired from the Shanghai area, after which the Japanese forces were withdrawn.

In Manchuria, however, Japan was not to be deterred from her course of conquest. A League of Nations commission, headed by the 2d Earl of Lytton, visited the Far East to make a firsthand

study and report. The Japanese government, though it accorded the commission adequate facilities for investigation, did not await its findings to execute Japanese plans. A puppet regime was created in Manchuria under the name of Manchukuo, which was given recognition on March 15, 1932 in a protocol defining Japan's special relation to the regime. The Lytton Commission's report, which appeared two weeks later, evoked bitter criticism in Japan, especially the report's denial of the plea that Japan had acted in self-defense, the finding that the creation of Manchukuo was contrived by the connivance of the Japanese Army, and the recommendations, implementation of which would have involved undoing the creation of Manchukuo. When the League of Nations Assembly adopted the recommendations (February 1933), Japan announced (May 27, 1933) her withdrawal from the League, effective at the expiration of the necessary two-year period. The League members and the United States withheld recognition from Manchukuo.

Sino-Japanese Relations, 1933-1937.—Between 1933 and 1937 the Japanese extended their aggressions from Manchuria farther into China. In January 1933 they occupied Shanhaikwan (Linyu) within the Great Wall. In rapid succession they conquered Jehol Province, which was annexed to Manchukuo, overran the eastern part of Hopeh Province, and forced upon the Chinese at Tangku a truce establishing eastern Hopeh as a demilitarized zone. In 1935, Gen. Yoshihiro Umezu exacted from Gen. Ho Ying-chin an agreement providing for the exclusion of the Chinese central government's troops from Hopeh and Chahar provinces, where a semiautonomous Hopeh-Chahar Political Council was constituted. Autonomous regimes were established under Japan's aegis in Inner Mongolia and East Hopeh, the latter becoming a base for smuggling Japanese goods into north China.

While Japanese military diplomacy, which was conducted independently of the Foreign Office, was thus active in north China, the imperial government had itself been moving toward a stronger foreign policy. On April 18, 1934, Foreign Office spokesman Eiji Amau emitted an official statement, known as the "hands-off China" statement, announcing that Japan would oppose certain types of third-power activities in China, such as political loans, military instruction, and joint projects of financial and technical assistance to China. Thereupon the United States reminded Japan that there were involved in the situation in China both American and international rights and obligations under international law and existing treaties. On December 29, Japan gave formal notice of her intention to withdraw at the end of 1936 from the Naval Limitation Treaty of 1922. After the lapse of that treaty Japan actively resumed the construction of capital ships to augment an expansion of armaments which had been under way for some time.

By 1936 mounting resentment in China against Japanese aggression resulted in growing Chinese unity and also in several incidents involving the killing or the injuring of Japanese subjects. When the Japanese ambassador in China sought, in conjunction with negotiating a settlement of the incidents, to dispose of "fundamental issues," the Chinese government refused even to discuss the questions of fiscal and administrative autonomy for the five northern provinces (in two of which, Hopeh and Chahar, this had been achieved

in fact), and of "joint Sino-Japanese defense against communism," a formula affording Japan a basis for asserting military control in north China. The Chinese in turn presented counter-proposals, which included cancellation of the Tangku truce and of the Ho-Umezu Agreement, dissolution of the East Hopeh regime, and cessation of Japanese smuggling. The negotiations ended in a deadlock. In December the National government and the Chinese Communists agreed to form a common front to resist Japan.

Sino-Japanese War.—A minor clash on July 7, 1937 between Chinese and Japanese soldiers at the Marco Polo Bridge near Peiping (Peking) brought the relations of their two countries rapidly to a crisis after the Chinese had refused to yield to Japanese demands for a local settlement which would confirm Japan's influence in north China. The Japanese made preparations to resort to force and the Chinese to resist. The Japanese government was unresponsive to an offer of good offices by the United States and sent heavy reinforcements to China. Soon hostilities became general and there ensued a conflict which influenced developments in Europe and four years later merged with World War II.

Japanese public opinion strongly supported its government, which remained united on objectives in China to the end of the war. On Sept. 5, 1937 the prime minister, Prince Fumimaro Konoye, informed the Diet that Japan's purpose was to force China to accept a basic readjustment of its relations with Japan, to which end the sole means then open to Japan was "to administer a thoroughgoing blow to the Chinese Army so that it will completely lose its will to fight."

The League of Nations Assembly's First Report on the conflict in the Far East, adopted Oct. 6, 1937, expressed the conclusion that Japan's military operations against China were out of all proportion to the incident which had occasioned these; that such action could not facilitate the friendly cooperation between the two nations which Japanese statesmen had affirmed was their aim; that Japan's action could be justified neither under existing legal instruments nor under the right of self-defense; and that it contravened Japan's obligations under the Nine-Power Treaty of 1922 and the Pact of Paris of 1928. The United States expressed its general concurrence with the conclusions of the League's Assembly. Nineteen nations in November 1937 participated at Brussels in a conference, held in accordance with a provision of the Nine-Power Treaty, to "study peaceful means of hastening the end of the regrettable conflict which prevails" in the Far East. The Japanese government's refusal to send delegates to the conference defeated the purpose to bring the conflict to an end through mediation and conciliation.

Japanese Rule in Occupied China.—In the areas of China which came under their military occupation the Japanese created regimes having a façade of Chinese control, but with real authority exercised by Japanese officials. The system offered a convenient subterfuge for disclaiming Japanese responsibility for infringement of the rights of third powers and for denying that Japanese assurances that they had no territorial ambitions had been violated. The Japanese government was thus also able to satisfy its own public that it had no enmity toward the Chinese people, but was combating only an anti-Japanese military leadership in the Chinese National government.

Japan's economic policy in occupied China early tended to establish such a general preference for Japanese interests as to deprive third-power nationals of equality of opportunity. Tariffs were lowered on Japan's staple imports, and discrimination in favor of Japanese enterprise was effected by the regulation, taxing, or prohibition of trade, by the imposition of exchange controls, and by the establishment of special Japanese-controlled companies, which were granted preferred status or monopolistic rights. As the Japanese armies advanced, they took possession of practically all publicly owned Chinese enterprise, such as railways, electric power companies, salt fields, waterworks, navigation facilities, and certain iron and coal mines, as well as industries which in large part were privately owned.

On Nov. 3, 1938, after the capture of Hankow and Canton, Japan announced that the Chinese National government had been reduced to a local regime and that it was Japan's aim to establish, in cooperation with China and Manchukuo, a new order in East Asia. On December 22, Prince Konoye announced Japan's peace terms, which were that China was: (1) to recognize Manchukuo; (2) to adhere to the Anti-Comintern Pact; (3) to accord Japan the right to station troops in areas to be stipulated by Japan (Inner Mongolia being designated as a "special anti-Communist area"); and (4) to agree to economic cooperation with Japan and to the extension of facilities for the Japanese development of natural resources (especially in Inner Mongolia and north China). This announcement was made by prearrangement with Wang Ching-wei, vice president of the Kuomintang, who had deserted the National government and was then in Indochina. On December 27, Wang declared that Konoye's terms were consistent with the principles of peace and proposed that the National government negotiate with Japan. As was expected, the National government ignored his appeal. Japan thus had prepared the ground for instituting on March 30, 1940 a Chinese regime in central China subservient to Japan, with Wang as its head. The Wang regime was recognized by Japan on Nov. 30, 1940 as the national government of the Republic of China in a "treaty" containing provisions substantially similar to the Konoye peace terms of Dec. 22, 1938.

Relations with Great Britain and the United States.—From the outset of the hostilities the rights and interests of third powers in China suffered from Japanese acts. British property interests in China were greater than those of any other power, but Great Britain was largely preoccupied with the crisis and the subsequent war in Europe. Consequently it was chiefly the United States that led in efforts to restrain Japan. On Dec. 12, 1937, Japanese aircraft bombed and sank the U.S.S. *Panay* in the Yangtze River under circumstances which pointed to either a deliberate disregard of consequences or negligence by some responsible person. The Japanese government called the act unintentional and made a prompt settlement, consisting of an expression of regret, assurances that measures would be taken against infringement of the rights and interference with the interests of the United States and other third powers, disciplinary action against the responsible commanders, and indemnification amounting to \$2,214,007.

The Japanese failure to keep the assurances given in connection with the *Panay* settlement

and the vain efforts by the United States to obtain the discontinuance of and redress for Japanese violations of American rights and the cessation of indiscriminate bombings from the air, which had caused the death of many thousands of the Chinese civil population and were jeopardizing the lives of third-power nationals, induced eventually, on July 1, 1938, the United States to place a moral embargo upon the export of aircraft and aircraft equipment to Japan. On October 6, in consequence of the Japanese government's continued failure to fulfill its repeated assurances to observe the principle of equality of commercial opportunity, the United States addressed to the Japanese government a comprehensive note on its discriminatory practices and interference with American rights and asked that these be discontinued promptly. The Japanese government's reply, on November 19, was an open challenge to the Western powers in the assertion of Japan's pretensions to the domination of China and it constituted a repudiation of the treaties concerning China. The note stated in part that Japan was devoting her energy to the establishment of a new order based on international justice throughout east Asia, the attainment of which end was indispensable to the very existence of Japan and was the foundation of the enduring peace and stability of that region. The conviction was expressed that in the new situation fast developing in east Asia an attempt to apply inapplicable ideas and principles of the past neither would contribute to the establishment of a real peace in east Asia nor would solve the immediate issues.

Since the Japanese note contained no satisfactory assurances for an amelioration of the situation, the United States on December 31 delivered to the Japanese government another note expounding more fully the American position. No reply to that note was made. On July 26, 1939 the United States notified Japan of its desire to terminate the Treaty of Commerce and Navigation of 1911. The United States reasoned that the treaty was not affording adequate protection to American commerce either in Japan or in Japanese-occupied portions of China, while at the same time the operation of the most-favored-nation clause of the treaty was a bar to the adoption of retaliatory measures against Japanese commerce. This notification came at a juncture when Great Britain was being subjected to pressure, through a partial blockade by Japan of the British and French concessions at Tientsin to surrender to a local Japanese-controlled court four Chinese whom the Japanese had accused of complicity in the murder of a puppet Chinese official. On August 18, however, the British ambassador informed the Japanese government that Britain would be unable to consider in a conference with Japan alone problems affecting the interests of third powers. It was not until a year later that the blockade at Tientsin was lifted, after the British had made substantial concessions to Japan. In July 1940 the British, under pressure of intense Japanese military activity near Hong Kong, agreed to stop the movement of military supplies from Hong Kong to Chinese territory and to close the Burma Road for the transit of certain war material for three months, on the understanding that during this period the Japanese would make a special effort to conclude a peace with China. On October 17 the Burma Road was reopened, since in the mean-

time Japan had made no serious diplomatic effort to come to an agreement with China.

Relations with the Soviet Union and Germany.—While Japan thus had been taking the offensive in China against the Western powers, she had been essentially on the defensive against the Soviet Union, at least after 1935, when Japanese pressure had effected the sale of the Russian interests in the Chinese Eastern Railway to Manchukuo. After the outbreak of the Sino-Japanese conflict, the Soviet Union, which viewed with concern the prospects of Japan's absorption of China, gave the Chinese government extensive aid in the form of military supplies and technical advice and by her military dispositions along the border immobilized in Manchuria a considerable part of Japan's best troops. An armed clash in July 1938 between Soviet and Japanese forces at Changkufeng Hill led to 10 days' fighting, and another clash in 1939 along the Mongolian border inaugurated extensive hostilities lasting from May until September. As a means of checking the Soviet Union, the Japanese Army, after the outbreak of the conflict with China, worked actively for a closer tie with Germany than that afforded by the Anti-Comintern Pact concluded in November 1936. Germany, which had extensive commercial interests in China, was none too pleased with Japan's program there and was willing to consider an alliance only if it assured Germany of Japan's support against Britain and France. Japan's civilian and naval leaders, however, opposed making commitments which might involve it in a European war. In May 1939, Baron Kiichiro Hiranuma, who in January had succeeded Konoye as premier, undertook a fresh initiative toward an alliance. Suddenly, on August 23, the conclusion of the German-Soviet Nonaggression Pact was announced. Germany's action without giving prior notice to Japan and the fact that the plea for an alliance had rested on its expected value against Russia resulted in the discrediting of the pro-German policies of the Hiranuma Cabinet and forced it to resign.

Expansion to the South.—The next Cabinet, under Gen. Nobuyuki Abe, sought a reorientation of policy toward the Anglo-Saxon powers, but this aim was foredoomed to failure, because Japan's "immutable" policy in China stood in the way of harmonious relations with them. After the outbreak of war in Europe on Sept. 1, 1939 the unconcealed eagerness in Japan to seize the opportunity thereby presented for the extension of empire southward was also an obstacle to good relations with the Western powers. The fall of France and the Netherlands in the spring of 1940 gave an additional impetus in Japan to the movement for southward expansion. As Britain and the United States stood in the way, they replaced Russia as the principal enemy in Japanese eyes. Moreover, as Germany now indicated that she no longer needed Japanese help in Europe, but wanted Japan to divert American attention from the Atlantic to the Pacific, the principal obstacles to an alliance were removed. Upon Konoye's resumption of the premiership in July, final negotiations ended in the signing of the Tripartite Pact on Sept. 27, 1940. Japan obligated itself thereunder to come to the aid of any of the parties thereto, if attacked by a power not at the time in the European war or in the Sino-Japanese conflict, other than the Soviet Union, which was expressly excepted.

Meanwhile, Japan had been pressing forward

in Indochina. On Aug. 30, 1940, a preliminary agreement was reached with France as a foundation for subsequent discussions. On September 22, three days after the issuance of a Japanese ultimatum, the French colonial authorities agreed to the Japanese use of three airports in Indochina and to the transit of Japanese forces for operations in China. Acting independently of the negotiators of the agreement, the Japanese Army in south China invaded Tonkin on the same day and five days of bloody fighting ensued.

After Germany's invasion of the Netherlands in May 1940, Britain, France, and the United States declared that they would respect the neutrality of the Netherlands East Indies. Japan gave similar assurances. Japan obtained from Germany assurances interpreted by Japan as giving her a free hand in the islands. In September a Japanese mission arrived in Batavia and demanded guarantees of delivery to Japan of 3,150,000 tons of petroleum products annually, an amount six times as large as the normal export to Japan, and extensive rights to exploit oil resources. The Dutch demurred and made a counteroffer beyond which they would not yield. Since the Japanese were not satisfied, the negotiations were suspended. Japan then sent to Batavia ex-Foreign Minister Kenkichi Yoshizawa, who in January 1941 presented far-reaching demands for special rights, which, if they had been accepted, would have placed the Indies under virtual Japanese economic control. When the negotiations reached an impasse, Yoshizawa returned in June to Japan empty-handed.

Japan's freedom of action for the southern enterprise was hampered by the undeclared and still unsettled war in China. China was receiving American, British, and Soviet aid. In July 1940, the United States had begun to deny licenses for the export of an expanding list of strategic commodities, including scrap iron, to Japan. Foreign Minister Yosuke Matsuoka made clear in the Japanese Diet on Jan. 21, 1941 that he would seek from the United States recognition of the vital concern to Japan of the establishment of the Greater East Asia Co-Prosperity Sphere, assent to Japan's supremacy in the Western Pacific, and cessation of economic restrictions upon Japan.

Japanese-United States Negotiations, 1941.—A new Japanese ambassador, Admiral Kichisaburo Nomura discussed in March and April 1941 with President Franklin D. Roosevelt and with Secretary of State Cordell Hull means of improving Japanese-American relations. He suggested the conclusion of a new agreement. Secretary Hull informed Admiral Nomura that the United States would consider any Japanese proposal for an agreement whose terms would be consistent with peaceful principles and purposes and that he would ask for assurances that the Japanese government had the willingness and the power to adopt those principles and to abandon its course of conquest. (During those two months Foreign Minister Matsuoka visited Berlin and Rome for the purpose of strengthening relations with the Axis. On his way home he stopped at Moscow, where on April 13 a neutrality pact between Japan and the Soviet Union was concluded.) Ambassador Nomura presented to Secretary Hull on May 12 a proposal for a general settlement, which was taken as a starting point for exploratory conversations, which were continued until December 1941. What the Japanese sought as

disclosed in that proposal and in subsequent formulations and clarification, was that the United States should stop interference, by its aid to the Chinese government, with Japan's efforts to impose a peace settlement on China on terms which had not changed substantially since 1936 and whose acceptance would have meant China's surrender of military and economic control of north China and of Inner Mongolia to Japan. Japan asked that normal Japanese-American trade relations be resumed and that the United States assist Japan to acquire rights to exploit natural resources in the Southwest Pacific. The United States made clear from the outset its unwillingness to discontinue aid to China and to be a party to a settlement between Japan and China which the latter could not accept freely by amicable negotiation. The United States expressed its readiness to offer its good offices for a settlement between China and Japan, to resume normal trade relations with Japan, and to assist Japan in endeavoring to obtain nondiscriminatory commercial access to raw materials in the Pacific area, provided that Japan abandon its policy of aggression, agree to respect in China the principle of nondiscriminatory treatment in international commercial intercourse, and make it clear that it was not under obligations under the Tripartite Pact to take action against the United States if the latter should be drawn by self-defense into the European war.

Germany's attack on Russia on June 22 precipitated an acute issue in the Japanese government on whether Japan should join the attack on Russia or complete the plan for southward expansion. The latter course was chosen at an imperial conference on July 2. Military preparations on a vast scale were launched, and soon a military movement into southern Indochina, which threatened the security of American, British, and Dutch possessions and vital trade routes south of China was begun. Secretary Hull suspended the exploratory conversations at Washington. On July 24, President Roosevelt proposed to Japan the neutralization of Indochina, but Japan was unresponsive to the proposal. On July 26, the United States froze Japanese assets in American territory, causing a virtual cessation of trade between the two countries. The British and the Dutch followed suit.

In August, following an initiative by Japan, the exploratory conversations at Washington were resumed and continued through the autumn. To a Japanese proposal for a meeting in the Pacific between the responsible heads of the two governments as a means of resolving the issues between them, the United States suggested that such a meeting should await agreement on essential principles and on their practical application. On November 20, Japan made what proved to be her final proposal. In it were repeated in blunt terms the essence of the demands from which Japan had never receded and there was no suggestion of any concession to the American views. The United States, after consulting with the British, the Australians, the Dutch, and the Chinese, answered Japan on November 26. The reply revealed the unacceptability of the Japanese proposal and contained what was essentially a summation of the American position which had been demonstrated fully. There was offered "for the consideration of the Japanese government a plan of a broad but simple settlement covering the entire Pacific area." On December 7, Am-

bassador Nomura delivered to Secretary Hull a communication containing an abusive tirade against the United States and announcing that Japan considered it impossible to reach an agreement through further negotiations. More than an hour before the delivery of this communication, Japanese armed forces had struck without warning at Pearl Harbor and had invaded British Malaya.

World War II.—Japanese armies proceeded rapidly to invade and to occupy American, British, and Dutch possessions in southeastern Asia and swarmed into Thailand, with whose government an alliance was concluded. Hong Kong fell on December 25, Singapore on Feb. 15, 1942, Batavia on March 5, Mandalay on May 1, and Corregidor on May 6. In the new acquisitions to the Coprosperity Sphere, much the same patterns were followed as had been adopted in China. In 1943, Burma and the Philippines were given "independence," but it was not until late in the war that independence movements were supported in Indochina and Indonesia.

After the loss of Saipan in June–July 1944, conviction of the inevitability of defeat began to grow in Japan, but the army had no plan except to fight to the bitter end. By the spring of 1945 leading statesmen reached the conclusion that in order to escape national annihilation peace must be obtained. In July, the Soviet government was approached with a view to its mediation with the Allies for a peace short of unconditional surrender, but the Soviet government rebuffed the approach on the ground that the basis proposed for peace was too indefinite. On July 26, the Allied powers issued at Potsdam a declaration outlining their terms of surrender to Japan. A few days later the Soviet government entered the war against Japan and adhered to the Potsdam Declaration. The declaration called for the limitation of Japanese sovereignty to Japan's four main islands and such minor islands as the Allies might determine, the disarming of Japan's military forces, the punishment of Japanese war criminals, the military occupation of Japan, and the eventual formation of a democratic government in Japan. Japan announced on August 10 its acceptance of these terms subject to the qualification that the emperor's prerogatives as sovereign would not be prejudiced. The Allies replied that the emperor's authority and that of the Japanese government would be "subject to the Supreme Commander for the Allied Powers, who will take such steps as he deems proper to effectuate the surrender terms." Japan accepted this answer, and on Sept. 2, 1945, Japanese representatives signed, on board the U.S.S. *Missouri* in Tokyo Bay, the instrument of surrender.

See also **ASIA**—sections 18 and 19; **CHINA**—8. *History* (War with Japan); **FAR EASTERN AFFAIRS**—*From World War I to World War II*; **WORLD WAR II**.

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was under foreign military occupation and subject to the orders of a supreme commander for the Allied powers (SCAP). It then resumed its position as a sovereign nation.

OCCUPATION

As defined in 1951, the Allied powers were the 55 nations (including some newly independent) considered to have opposed Japan in World War II. Most of them, however, had no voice in the occupation. The SCAP staff was almost exclusively American, and except for a Commonwealth of Nations force (Australian, British, Indian, and New Zealand) in the Hiroshima area, the occupying forces also were American. Plans to use Chinese and Russian troops were blocked by the outbreak of civil war in China and the Soviet rejection of United States command.

A total of 13 powers took part in international agencies established to deal with Japan. (The United Nations, as such, had no direct connection with the occupation.) An Allied Council for Japan, with one member each for the United States, the USSR, and China, and one for Australia, Great Britain, India, and New Zealand together, was set up in Tokyo to advise SCAP, but it had little influence on events. These 7 nations, plus Canada, France, the Netherlands, the Philippines, and, later, Burma and Pakistan, formed a Far Eastern Commission (FEC), with headquarters in Washington. FEC authority to determine occupation policy was limited by a veto power given to the United States, the USSR, Great Britain, and China, and especially by a provision that the United States could issue unilateral interim directives to SCAP on almost any matter not as yet decided by the FEC. These directives could not be reversed without United States consent. Most FEC decisions thus reflected policies already determined by the United States. Having borne the brunt of the war against Japan, the United States claimed predominance in the occupation. While this claim caused friction with other powers, it spared Japan the territorial partition and bitter impasses in policy that plagued occupied Korea and Germany in the postwar period.

Basic Policy.—The Cairo Declaration of Dec. 1, 1943, committed the United States, Great Britain, and China to punish Japanese aggression and to strip Japan of its conquests. In the Potsdam Declaration of July 26, 1945, these three powers (with the USSR later adhering) demanded an unconditional surrender and announced their intention of occupying Japan until certain broad objectives had been achieved. Acceptance of this declaration by Japan on August 14, formalized in the instrument of surrender of September 2, completed the legal basis for occupation. A United States Initial Post-Surrender Policy for Japan was sent to SCAP on August 29 (it was reissued by the FEC in 1947 with little change). Then, in November 1945, the United States issued a much longer Basic Initial Post-Surrender Directive to SCAP for the Occupation and Control of Japan, specifying major policies in detail but leaving SCAP large discretionary powers.

Planning for postwar policy toward Japan had begun in 1942. United States officials were deeply divided over the issue of a hard or a soft peace. The sharpest disagreements concerned the treatment of the emperor and the civilian leaders, especially the industrialists. Advocates of a soft peace argued that deposing or jailing the emperor

23. OCCUPATION AND FOREIGN RELATIONS SINCE 1945

From Sept. 2, 1945, to April 28, 1952, Japan

would produce chaos and hatred in Japan, jeopardizing both the safety of the occupying troops and the success of their program. Proponents of a hard peace considered the imperial system to be so closely connected with aggression that failure to destroy it would doom occupation reforms. A similar dispute arose over the wisdom of using Japanese civilian leaders to maintain a stable government and prevent economic collapse. Neither faction won a clear decision. SCAP applied a mixture of hard policies and soft policies, a procedure that at times resulted in compromise and contradiction.

It was agreed that Japan, unlike Korea and Germany, would retain its existing governmental machinery, both national and local. SCAP would rule not directly, but through the Japanese government. This decision reduced to manageable proportions the problem of controlling with less than 500,000 foreign troops an enemy nation of 80,000,000 persons. It relieved the occupation of responsibility for myriad day-to-day decisions and thus enabled SCAP to choose the times and occasions to intervene. On the other hand, it enabled some Japanese to obstruct SCAP orders, partly because the occupation never developed adequate machinery for verifying compliance.

Organization and Procedure.—SCAP headquarters in Tokyo consisted of 4 general and 18 special staff sections responsible to the supreme commander (General of the Army Douglas MacArthur from 1945 to April 11, 1951; Gen. Matthew B. Ridgway thereafter). The chiefs of nearly all of the sections were United States Army officers, but most of the personnel were American civilians. The division of functions among SCAP sections roughly paralleled that within the Japanese cabinet. Subject to SCAP approval, the staff sections issued orders to the central Japanese government in Tokyo. During seven years of occupation more than 2,200 written directives and 7,500 written administrative orders were issued, but after 1947 most instructions were oral. In general, the occupation worked through the cabinet, and with few exceptions it avoided direct contact with the Diet and the judiciary. Many SCAP directives necessitated new or revised laws or executive ordinances. It was the cabinet's responsibility to issue such ordinances or to have the Diet enact suitable laws.

The occupying forces, consisting chiefly of the United States Eighth Army and the subordinate British Commonwealth forces, had little to do with governing Japan. Their function was to defend the country from attack and, on rare occasions, to maintain domestic order when the Japanese police could not do so. Until late 1949, however, the Eighth Army included 45 prefectural teams of civil affairs officials who supervised prefectural and municipal governments in the local implementation of laws and orders received from the national Japanese government in Tokyo. They were hampered by a lack of authority to issue formal orders to their Japanese counterparts or to communicate directly with SCAP staff sections. In 1949 these teams were disbanded, and their functions were taken over by eight regional teams reporting to SCAP headquarters. The advantages of this administrative simplification were offset by a sharp reduction in personnel, and in any case the change was too late to have much effect on policy. Particularly after the Korean War began in June 1950, occupation supervision of programs other than economic stabilization was relaxed.

Role of Japan.—The character of the Japanese response had much to do with the course of occupation policy. Events disproved some basic assumptions of both hard and soft factions. SCAP orders met a fair amount of resistance and evasion within the Japanese government, but the reaction of the people in general was unexpectedly docile and cooperative. This development led SCAP not only to de-emphasize punitive policies rather early in the occupation, but also to extend reforms into fields not contemplated originally. On the other hand, Japanese cooperation was largely passive, and democratic initiative developed slowly and haltingly. As a result, the SCAP staff assumed the principal role in planning major reforms. Military defeat had discredited the old order and had made Japan ripe for social, economic, and political change, but receptivity to change did not ensure genuine understanding or assimilation of the ideas underlying SCAP policies.

Development of the Occupation.—Though not so planned, the occupation passed through two contrasting phases. From 1945 to early 1948, SCAP was concerned chiefly with retribution and reform, the latter becoming steadily more important. Many programs of this phase continued to the end of the occupation, but from 1948 on they were overshadowed and at times undermined by emphasis on economic rehabilitation.

Demilitarization.—Initially, SCAP's primary mission was to deprive Japan of the capacity to wage war. A new constitution, written by SCAP officials, renounced war and prohibited the maintenance of armed forces. On March 6, 1946, General MacArthur defined this prohibition as applying even to self-defense forces, but he reversed his position on Jan. 1, 1950, and Japan began to rearm six months later. By that time, however, the country had been effectively demilitarized by the following means:

Demobilization.—The Japanese Army and Navy were disbanded. The forces at home were discharged by late 1945, and those overseas were gradually repatriated and demobilized; except for personnel still interned by the USSR, the process was finished by early 1948.

Disarmament.—Weapons, ammunition, and fortifications not needed by SCAP were destroyed. Naval vessels were divided among the United States, the USSR, China, and the Commonwealth. Munitions factories were closed or converted to nonmilitary production, and Japan was forbidden to possess aircraft of any kind.

War Crimes Trials.—Japanese charged with crimes against humanity or with violations of the laws and customs of war were tried by individual Allied powers. At least 6,000 were convicted (the total is unknown because of inadequate reports from the USSR and Communist China, where trials continued as late as 1957). An 11-nation International Military Tribunal for the Far East, meeting in Tokyo, convicted 25 senior Japanese civil and military officials on similar charges and on charges of plotting or waging aggression. All of the trials were designed not only to judge the defendants, but also to produce public abhorrence of their actions.

See also WAR CRIMES.

Purge.—Between January 1946 and May 1948, more than 200,000 Japanese classified as "active exponents of militant nationalism or aggression" were barred from public office and "positions of important responsibility or influence" in industry, finance, commerce, agriculture, press, and radio.

Many others resigned voluntarily or were excluded only from certain offices. Ultranationalist societies were outlawed.

Reparations.—The exaction of reparations was designed as much to curb Japan's war potential as to aid its victims. Japanese overseas assets, valued at \$3 billion or more, were taken over by various Allied powers as compensation for war costs. Japan was also scheduled to transfer capital equipment to nations that had sustained damage from its attacks, but only about \$40 million worth of machinery had been removed by 1949, when the program was discontinued.

See also REPARATIONS.

Democratization.—The destruction of Japan's capacity for war was to be complemented by the elimination of the desire for war. This aim was to be achieved by democratization: a series of political, social, and economic reforms designed to improve the lot of ordinary people and to make the government responsive to popular will, presumably pacifist. Major changes are described in more detail in other sections of this series; the following recapitulation can only suggest their scope and variety.

Civil Liberties.—Censorship was abolished. The notorious "thought control" law (Protection and Surveillance Law for Thought Offenses) of 1936 and many similar laws were abrogated. Secret police organs were dissolved, and political prisoners were freed. State Shinto, the quasi-religious cult of chauvinism that had been a compulsory creed for all Japanese, was disestablished by means of a ban on government support. The new constitution went well beyond the American Bill of Rights in guaranteeing individual freedom.

Family System.—Heads of households lost their legal authority over other adult members of the family. Primogeniture was abolished. Legal emphasis was centered on individual rather than on family rights and responsibilities.

Women's Rights.—Women acquired legal equality with men (specifically, for example, in education, suffrage, marriage, and divorce). They were elected to many political offices, and their organizations acquired greater political and economic influence.

Labor.—SCAP actively encouraged the formation of labor unions, which had been virtually proscribed. Nearly 5 million workers had joined unions by the end of 1946, and a year later the aggregate membership exceeded 6 million. Organized labor soon became a major political force, generally in opposition to the government. Liberal laws on labor relations and labor standards were enacted.

Land Tenure.—Land reform was designed to eliminate absentee ownership of arable land and to reduce tenant farming. Nearly 3 million tenants became farm owners through a program of government purchase and resale of land formerly held by absentee or noncultivating owners and through the imposition of a ceiling on the amount of farmland one family could own. SCAP also encouraged the creation of farmer-controlled cooperatives for purchases, sales, and finance. By 1949 nearly every farm household belonged to at least one cooperative of this kind.

Economic Concentration.—In its first phase the occupation sought to break up excessive concentration of economic power, through which a dozen families were reputed to control 80 percent of the nation's commerce, industry, and finance. Deconcentration or decartelization was intended to



World Wide Photo

Televised cooking lessons exemplify Japan's modernization and a growing attention to the interests of women.

redress the economic balance of power and to give greater protection and opportunity to small- and medium-scale enterprises. Steeply graduated income taxes and inheritance taxes were imposed. Antimonopoly laws were enacted, and *zaibatsu* (economic clique) holding companies and interlocking directorates were dissolved. The operations of other *zaibatsu* companies were restricted by SCAP order.

Class Structure.—By the above-mentioned steps and other means, SCAP did much to make reality approach the ideal, expressed in the new constitution, that all the people were equal. Two privileged classes, the armed forces and the peerage (except the imperial family), were abolished, and legal curbs were placed on a third class, the major industrialists and financiers. Meanwhile, two underprivileged classes, the farmers and the workers, received SCAP's help in improving their position.

Education.—Textbooks were revised to delete ultranationalist dogma, and the special courses in chauvinism known as *shūshin* (ethics) were abolished. Ministry of Education control of the school system was radically curtailed; secondary schools were placed under the supervision of popularly elected local boards of education. The various educational systems were consolidated and reorganized along American lines. Coeducation was expanded, and the period of free compulsory education was increased to nine years. The opening of new colleges and universities was encouraged.

Police.—The highly centralized police force was divided into independent local forces (for municipalities of 5,000 persons or more) and a National Rural Police whose units were controlled by prefectural rather than national authorities. Stringent constitutional limits were imposed on police powers of search, seizure, arrest, detention, and interrogation.

National Government.—The prime minister and the cabinet were made responsible to a Diet (Parliament) elected by universal suffrage. The Supreme Court acquired the power of judicial review of legislative and executive acts and became a coordinate branch of government. The vast powers formerly reserved to the emperor and exercised in his name by a motley oligarchy were divided among the cabinet, Diet, and judiciary, leaving the emperor only ceremonial functions.

Local Government.—The Ministry of Home Affairs, which had controlled local government

as well as the police, was abolished. The offices of governor, mayor, prefectural assemblyman, and municipal assemblyman became popularly elective. The prerogatives of prefectural and municipal governments, and especially of their assemblies, were increased. This general emphasis on local autonomy was, however, offset by financial difficulties created by the transfer of responsibilities formerly supported by national funds. As time passed, the growing dependence of local governments on national aid and subsidies tended to re-establish a measure of centralized control over them.

Rehabilitation.—The Initial Post-Surrender Policy minced no words about rehabilitation: "The plight of Japan is the direct outcome of its own behavior, and the Allies will not undertake the burden of repairing the damage." It was soon evident, however, that without Allied help a crushed Japan could not avert widespread starvation and disease, which might endanger the occupation itself. During the first phase, SCAP therefore augmented Japan's food supply by substantial imports from the United States, and, despite objections from other Pacific nations, revived Japanese fishing and whaling operations outside the immediate Japanese area. SCAP staff sections took the lead in seeking ways to increase food production, and food rationing and price controls were continued. The problems of public health, compounded by the repatriation of more than 6 million Japanese from other parts of Asia, were a major concern, and strenuous efforts were made to improve and expand health services and facilities.

While the United States supplied massive aid to Japan, especially in the form of food, chemicals, and fertilizers, however, the SCAP program of relief and rehabilitation was not intended to solve the problems of the economy as a whole. The initiative in planning economic recovery was left largely to the Japanese, whose efforts, despite repeated prodding by SCAP, were dilatory and thus ineffectual. After two years of peace, inflation was still increasing, industrial production was well below half the 1930-1934 average, and exports were at a dangerously low level. The doctrine that Japan must rebuild its economy by its own efforts and sacrifices had clearly become untenable. Though morally justifiable, it had proved politically and economically unrealistic. Without a viable economy the new social and political structure created by the occupation might be undermined. During 1948, therefore, economic stabilization became the central theme of SCAP policy. A special mission from the United States drafted a strict austerity program "to achieve fiscal, monetary, price and wage stability" and "to maximize production for export." In December of that year, SCAP ordered the Japanese government to put this program into effect immediately. Other missions were sent from the United States in 1949 to supervise the program and to plan a radical revision of the tax structure.

The 1948 change in policy involved more than the assumption by SCAP of economic functions previously left largely to the Japanese. It was accompanied by a belated sense of urgency and a willingness to subordinate nearly all other considerations to the primary one of restoring the economy. Reform programs now had to be justified not so much on philosophical grounds as on their ability to be carried out without harm to recovery. This fundamental change in occupation

attitudes created conflict and confusion within SCAP headquarters as well as among the Japanese. While one SCAP section, for example, exerted pressure on Japanese officials to undertake a massive program of school construction, another was enforcing austerity measures that minimized expenditure for anything but productive investment.

By SCAP initiative or consent many earlier policies were modified or reversed on the ground that they might impede or divert effort from the main goal of economic recovery. In 1948 strikes by government employees were forbidden, not only in the regular civil service, but also in the state-owned railways, postal, telegraph, and telephone services, and salt, tobacco, and camphor monopolies. Reparations removals were ended in May 1949 despite objections by most of the Allied powers in the Pacific area. The economic deconcentration program, long a target for bitter criticism in the United States as well as in Japan, was virtually abandoned. After much argument the Japanese government was allowed in 1950 to start terminating the purge and reinstating persons who had been barred from economic and political positions.

Two external developments ensured continuance of the new policy. The Communist conquest of China in 1949 made it clear that Japan rather than China would have to be the cornerstone and industrial base of any non-Communist or anti-Communist coalition in the Western Pacific. When the Communists invaded South Korea in 1950, the United Nations forces were compelled to rely on Japan not only as their principal forward base of operations, but also as a major source of essential goods and services. The result was an expansion of industry as well as an economic windfall for Japan.

Collateral Changes.—Many of the innumerable changes that took place in Japan during the occupation were due in whole or in part to factors over which SCAP had little or no control. The Japanese have always been remarkably eclectic, and the shock of military defeat caused many of them to regard everything old or native as outmoded and anything new or foreign as desirable. The presence in Japan of hundreds of thousands of Westerners gave the ordinary citizen, even in rural areas, an unprecedented opportunity to observe or learn of a different way of life.

Social processes that had been developing for a generation or more were suddenly accelerated. The steady disintegration of the hierarchic family system was one example; SCAP legal reforms stressing individual liberty and equality intensified a trend long since set in motion by progressive urbanization and industrialization. Similarly, there was a strong movement to compensate for lost time in many important fields of activity. Japanese scientists, educators, and businessmen saw that wartime isolation had caused their country to fall nearly a decade behind other modern powers in methods, instruments, and technology. Their interest in overcoming this handicap was actively encouraged by SCAP staff sections.

Daily life, especially in the cities and in the vicinity of occupation bases, was changed in many ways by the introduction of new (chiefly American) customs and commodities. Western music, food, motion pictures, and books became very popular. Wives took to walking beside their husbands rather than deferentially behind them, and many superficial aspects of Western life were

avidly imitated. On the other hand, the lifting of governmental restrictions on civil liberties caused a vast expansion in the number of serious and scholarly books and magazines being published, and subjects formerly forbidden for political or ideological reasons were now studied and discussed openly. The ideas and ideals not only of democracy but also of various brands of Marxism and socialism gained a wide vogue.

Even language was affected. The already large vocabulary of words borrowed from English was rapidly expanded, often without demonstrable need. Long-frustrated advocates of language simplification or of romanization were encouraged to renew their efforts. The occupation, though sympathetic, decided not to intervene in this field, but the Japanese government sponsored a series of language reforms which, if modest, were by no means negligible.

Achievements.—The shortcomings of the occupation were not hard to see. Many of them could be traced to indecision concerning objectives. For example, it was never clear whether the purge was meant to be punitive (as the Japanese assumed) or preventive (as SCAP insisted). The desire to encourage Japanese initiative came repeatedly into conflict with the need for more rapid or more extensive action. Postulating Japanese initiative did not create it, and efforts to conceal SCAP leadership were ineffectual. Delay in accepting economic rehabilitation as a SCAP mission not only caused recovery to be more difficult and more costly, but made it hard to integrate recovery and reform programs without detriment to the latter. Many Japanese felt that the democratic principles taught in the occupation's first phase were forgotten in the second.

Even in the first phase the Japanese were disturbed to learn that the occupation sometimes seemed not to practice what it preached. Censorship was outlawed, but the occupation imposed its own censorship. Freedom of the press did not extend to criticism of SCAP, however mild or constructive. The purge excluded men from public or private office without a hearing in most cases, and then placed on them the burden of proof in any appeal. Government by decree was anathematized and made unconstitutional; yet SCAP allowed and at times encouraged the cabinet to carry out occupation reforms by executive ordinance rather than permit the Diet to debate them in the form of proposed laws.

Few doubted that SCAP had both the right and the duty to use all necessary means, however peremptory, to transform Japan's oligarchy into democracy. The difficulty was that SCAP seemed to renounce this fundamental premise: first by trying to camouflage SCAP direction with fictitious Japanese initiative, and then by creating a liberal constitution before completing the destruction of antidemocratic institutions. All steps that SCAP considered essential would have been legal under the old constitution. Many of them seemed illegal under the new one, and this fact did not enhance the prestige of SCAP, the cabinet, or the constitution. In this sense, promulgation of the new constitution probably came too soon.

Two other basic weaknesses of the occupation should be mentioned. There was a tendency to equate democratization with Americanization. American experience and solutions were often assumed to be fully and uniquely applicable to the problems of a country radically dissimilar to the United States in resources, traditions, experience,

and psychology. There was also a tendency to underestimate the need for verifying compliance with reform decrees once they had been translated into Japanese law. Poor liaison between SCAP staff sections and prefectural civil affairs teams was a symptom rather than a cause of this weakness.

The achievements of the occupation did not measure up to SCAP's claims, but the claims themselves were immoderate and unrealistic. Neither this imaginary perfection nor the real shortcomings of the occupation are adequate criteria. Measured against history rather than against its own extravagant propaganda, the occupation appears to have been more successful than anyone could reasonably have expected. It did not work miracles. It did not, as SCAP contended, revolutionize Japanese thought "almost overnight"—or in seven years. It made many mistakes and had many failures. But it also produced many solid accomplishments above and beyond the specific reforms mentioned above.

Japan was flooded with unfamiliar ideas, many of which took root, even if only imperfectly. Independent habits of thought won new prestige in a society where individuality was considered unorthodox. The occupation helped to strengthen (perhaps too much) a new-found spirit of pacifism in a nation historically bellicose. It abolished legal inequalities and did much to reduce social and economic inequalities. It gave large segments of the population—farmers, workers, women—at least an opportunity to improve their position. It destroyed most of the apparatus of oligarchic rule that had made democracy impossible, and thus gave the Japanese an opportunity that they had never been able to create for themselves. It restored a devastated economy to a reasonably viable condition. It introduced new methods and concepts into almost every phase of Japanese life without destroying national identity.

These sweeping changes were made, moreover, with a minimum of rancor on either side. They were not, of course, the unilateral achievement of one occupying power, much less of any one man or group. Japanese cooperation was an essential ingredient. While this cooperation was often devoid of real comprehension of SCAP philosophy, it helped the innovations to gain a foothold that proved firmer than many observers had suspected. Postoccupation governments found it expedient to move with remarkable caution in modifying (not to mention reversing) SCAP reforms. There was nothing like the rapid, wholesale repudiation predicted by pessimistic observers. The occupation produced some irritation and some disappointment among the Japanese, but it left a majority of them basically well disposed toward the chief occupying power, even if often critical of its policies. No previous occupation in history could justly claim more.

FOREIGN RELATIONS SINCE 1945

For five years after World War II, Japan was more or less isolated from the rest of the world, though not so strictly as in Tokugawa times. Diplomatic relations were conducted only through SCAP, and little nonessential travel from or to Japan was permitted. Beginning in 1950, controls were gradually relaxed to encourage trade, but the resumption of normal diplomatic relations had to await a treaty of peace. This was concluded in San Francisco on Sept. 8, 1951, and took effect on April 28, 1952.

Peace and Security Treaties.—As a treaty of reconciliation rather than reprisal, the Japanese Peace Treaty imposed lenient terms. The occupation was ended, and full sovereignty was restored. Japan renounced all claims to Korea and to its former island colonies and mandates—Taiwan (Formosa), southern Sakhalin, the Kuril, Marshall, Mariana, and Caroline Islands, and various smaller groups—as well as all special rights in China. The Ryukyu and Bonin Islands were left under United States control without renunciation of Japanese sovereignty. While the right of self-defense was recognized, Japan accepted the obligations in the United Nations Charter for the peaceful settlement of international disputes. Reparations claims were left for bilateral negotiation, but the treaty recognized Japan's incapacity to make complete reparation.

For various reasons, the Communist bloc and some Asian countries were not parties to the San Francisco Treaty, and Japan had to find other means of normalizing relations with them. Peace treaties were signed with Nationalist China and India in 1952, but disputes concerning reparations delayed for several years the restoration of full diplomatic relations with Southeast Asian states. Territorial and repatriation disputes also blocked a proposed peace treaty with the USSR, but diplomatic relations between the two countries were resumed in December 1956. Similar arrangements were made with most other Communist regimes except those in the divided countries (China, Vietnam, Korea, Germany). Relations with South Korea, as well as with North Korea and Communist China, remained acrimonious and unstable.

A security treaty with the United States, effective on the same day as the San Francisco Treaty, authorized the stationing of American land, air, and sea forces in and around Japan until the latter could assume responsibility for its own defense. Thus most occupation forces were not withdrawn in 1952 but merely renamed. Moreover, they retained privileges that led many Japanese to argue that Japan was still not a free agent. Friction developed concerning criminal jurisdiction over Americans charged with offenses against Japanese, the right of the United States to use Japanese bases for military operations outside Japan (for example, in the defense of Taiwan), the acquisition of farmland for airbase expansion, and the introduction of nuclear weapons into Japan. Demands for a stronger Japanese voice in joint defense arrangements led to the conclusion of a new treaty in 1960. The indefinite duration of the 1952 treaty was changed to permit unilateral denunciation after 1970. Although the details were vague, the United States was required by the new treaty to consult Japan on major military movements affecting its Japanese bases. Japanese Communists and Socialists persuaded many of the people that the new treaty made Japan's position worse rather than better. Violent demonstrations and riots by labor and student groups failed to prevent ratification (June 23, 1960), but they caused the fall of the cabinet of Prime Minister Nobusuke Kishi and revealed the fragility of Japan's commitment to the American alliance.

Development of a Foreign Policy.—Such events as the 1960 demonstrations reflected the chronic dilemma of Japanese foreign policy after 1952: whether to remain in the anti-Communist bloc or to follow a neutralist course. Strong forces pulled in each direction. The choice was influenced not primarily by ideology but by Japan's unaccus-

tomed lack of military power, its exposed position close to the two major Communist states, and its extreme dependence on foreign trade.

Japan began rearming in 1950 under American pressure and with American aid, but the pace was slow and the goal unclear. The vastly increased cost of modern weapons systems and the necessity of making a fresh start after total demilitarization made it obvious that military parity with the great powers was no longer possible. Many Japanese felt that rearming on the lesser scale that Japan was able and willing to undertake might be a handicap rather than an asset. Apart from widespread doubts concerning the constitutionality of rearming, there was also general opposition to massive spending for defense, and the government cautiously held military costs to less than 10 percent of the budget.

But the crux of the military dilemma was the proximity of the USSR and Communist China, whose 1950 treaty of alliance was expressly directed against Japan. This was at once the cause of and the chief deterrent to Japanese rearmament. The Socialists argued that the presence of armed forces, whether Japanese or American or both, merely ensured Japan's involvement in any new war. Incessant Soviet and Communist Chinese threats to destroy Japan if war came were resented but were taken very seriously. In the climate of ardent pacifism that dominated Japan after 1945, the Socialist dream of inexpensive safety through disarmed neutrality had a powerful mass appeal.

On the other hand, Japan's economic ties with the anti-Communist West became steadily stronger. Trade with the United States, accounting for approximately one third of Japan's imports and one fourth of its exports, dwarfed that with any other nation, although the fact that the trade balance was usually unfavorable to Japan created many difficulties. In May 1962, Japan joined nine Western industrial nations in creating a buffer fund under the International Monetary Fund to guard against dangerous fluctuations in international exchange. Next to India, Japan was the largest beneficiary of the Western-financed International Bank for Reconstruction and Development, and by 1962 had received 24 long-term loans totaling \$487.9 million for major industrial projects.

Faced with these divergent considerations, successive conservative governments proclaimed Japan's adherence to the anti-Communist alignment but actively sought closer ties with neutrals and better economic relations with Communist states. The result was that Japanese policy often seemed ambivalent. Neutralist states thought it too anti-Communist, while anti-Communist states found it too neutral. Both groups suspected Japan of opportunism.

Japan's indecision was complicated by a kind of ostracism resulting from its past actions. Humiliations dating back half a century made China, Korea, and the USSR vindictive. More recent aggression left a residue of hostility and mistrust in most of the Pacific countries, especially the Philippines and Australia. Great Britain and other nations, including the United States, were apprehensive concerning renewed Japanese competition in world markets.

After 1952, Japan pursued respectability and acceptance through many avenues. Membership in international organizations was avidly sought: Japan joined no less than 25 in the first year after

signing of the San Francisco Treaty and many more later. Admission was often difficult. Soviet vetoes kept Japan out of the United Nations until December 1956, and opposition from the members of the Commonwealth and other countries blocked accession to the General Agreement on Tariffs and Trade (GATT) until September 1955, and thereafter limited application of GATT provisions to trade with Japan. State visits to and from Japan multiplied, and international conferences of all kinds were held in Tokyo. Many international sports meets, including the 1964 Olympic Games, were invited to Japan. Japanese scientists were active in the International Geophysical Year program of 1957–1958. Tourism and international trade fairs were vigorously promoted. These varied activities helped to restore Japanese self-confidence and reduce the feeling of isolation; some of them also helped to improve the country's economic position. Nevertheless, Japanese diplomacy had still to face many difficult problems.

Trade Expansion.—With the loss of its empire, Japan was more than ever dependent on foreign trade. The expansion of trade required good relations with other countries, especially in Asia, where the Greater East Asia Coprosperity Sphere of the early 1940's had proved to be a euphemism for conquest. Major steps in making amends were reparations agreements concluded with Burma (1954), Thailand (1955), the Philippines (1956), Indonesia (1958), and South Vietnam (1959). Though scheduled to cost Japan more than \$1.3 billion in goods, services, loans, and investments over a decade, they were accepted as unavoidable sacrifices. Nevertheless, the recipients were not wholly satisfied. The Philippines alone had originally demanded \$8 billion in reparations, finally settling for one tenth of that sum.

In 1954, Japan joined the Colombo Plan for Cooperative Economic Development in South and Southeast Asia and intensified its efforts to expand trade with this area. Aside from competition by western European industrial powers, the chief difficulty encountered was the weakness of other Asian economies. To develop stronger trading partners, Japan encouraged the movement of private capital into South and Southeast Asia, in addition to investments made under reparations agreements. In 1960–1961 agreements were made to invest in the five-year economic programs of both India and Pakistan, and trade fairs and state visits promoted trade throughout southern Asia. Meanwhile, commercial treaties were concluded with most Asian countries and with many in Europe and Latin America. A major achievement was Great Britain's agreement, in a six-year commercial treaty signed in November 1962, to refrain from applying the GATT escape clause to Japan (that is, to extend to Japan the usual GATT concessions).

Trade with the Communist bloc was affected by political complications. Many Japanese businessmen, ignoring fundamental changes in the mainland Chinese economy after the Communist conquest, had grandiose visions of reviving lucrative trade with China after the Korean War. At the insistence of Japan and most of the other allies of the United States, international restrictions on exports to China were gradually relaxed after 1957. But the Chinese overplayed their hand, injecting into the trade negotiations sweeping political demands: diplomatic recognition, severance of relations with Taiwan, support for seating Peking

in the United Nations, and abandonment of the American alliance. When the Japanese government rejected these demands in 1958, China banned trade with Japan, although a trickle of private trade persisted. Japanese Socialists continued to urge both political and economic rapprochement with China, but businessmen increasingly suspected that the Chinese were much more interested in securing political concessions than in buying Japanese products. Trade relations with the USSR were better, especially under three-year agreements signed in 1960 and 1963. A three-week Soviet trade fair was held in Tokyo in August–September 1961, and the volume of trade, though still relatively small, gradually expanded. Short-term commercial agreements were also concluded with some of the minor Communist states in Europe.

Fishery Disputes.—After the occupation, Japan was involved in disputes with its Pacific neighbors concerning access to traditional fishing grounds. The USSR claimed the right to control fishing everywhere in the Sea of Okhotsk. South Korea forbade Japanese fishing ships to enter a large section of the Japan and Yellow seas adjacent to Korea. Both countries seized Japanese ships, interned the fishermen for long periods, and often kept the ships, alleging a need to prevent Japan from depleting marine resources. Communist China and North Korea followed similar policies on a smaller scale. Fisheries agreements were concluded with the USSR (officially) and with China (privately), but the terms were unfavorable to Japan. The USSR insisted on annual renegotiation and imposed steadily more onerous restrictions on the Japanese. American efforts to mediate the bitter dispute with South Korea were unsuccessful, but a controversy with Australia over fishing and pearling in the Arafura Sea was settled amicably in 1954, and in 1961 Australia agreed to a three-year pact, replacing annual negotiations.

Japanese anger over American and British nuclear tests was aggravated by interference with fishing operations. The most serious incident was the radioactive dusting of a Japanese tuna boat 80 miles off Bikini on March 1, 1954; 23 crewmen were hospitalized for more than a year and 1 died, causing much animosity in Japan toward the United States, although the tests had been announced in advance. While not directly affecting fishing, Soviet and French nuclear tests also drew prompt and vigorous Japanese protests. Nuclear testing was the only important issue on which Japanese Socialists criticized the USSR.

Repatriation.—Communist refusal either to repatriate or to account for approximately 300,000 of the Japanese soldiers and civilians seized at the end of World War II in Manchuria, Korea, the Kurils, and Sakhalin caused much resentment, chiefly against the USSR. After long negotiations, small-scale repatriation was begun by Communist China and the USSR in 1953 and by North Korea in 1955. It continued until August 1957, 12 years after the war had ended and nearly 9 years after the completion of repatriation from non-Communist areas.

Two other groups presented repatriation problems. The internment of Japanese fishermen by other countries was a continuing harassment. Conversely, the repatriation in 1959–1962 of 80,000 Koreans to North Korea caused new friction between Japan and South Korea and left unresolved the chronic dispute over the treatment and status



Japan's chemical fertilizer factories, such as the one shown here, are among the important enterprises that contribute products both for domestic use and for the export trade.

Pictorial Parade

of the approximately 575,000 other Koreans who remained (and evidently preferred to remain) in Japan.

Territorial Issues.—At least in public, Japanese irredentism was confined to efforts to recover small nearby islands. Aside from a trivial but heated dispute with South Korea over Take-shima (Liancourt Rocks), a small, uninhabited island used by transient fishermen, the chief territorial issues concerned the Kuril, Ryukyu, and Bonin Islands. All had been Japanese from the 1870's (well before the first war of conquest) until 1945. The San Francisco Treaty left the Ryukyus and the Bonins under United States rule "pending the making" of a proposal to the United Nations for American trusteeship. The treaty obligated Japan to concur in any such proposal, but the United States continued to recognize Japan's residual sovereignty over the islands. On Dec. 24, 1953, however, the United States returned to Japan the Amami-gunto lying between Kyushu and the main Ryukyu Islands. This action, and the probability that the USSR would veto any proposal for United States trusteeship over the remaining islands, intensified Japanese (and Ryukyuan) agitation for the return of all of them to Japan. Having built Okinawa, the largest of the islands, into the principal defense bastion in the Western Pacific, the United States declined to relinquish control until international tension eased. Japan proposed a compromise whereby civil administration would be turned over to it, while the United States retained the military bases. Faced with mounting difficulties under a similar arrangement in Japan itself, the United States rejected the proposal, but in 1962 it granted greater autonomy to the Ryukyuan government and reaffirmed its recognition that the islands were "a part of the Japanese homeland." Although the Bonin Islands remained closed to Japanese, the United States agreed in 1961 to compensate former residents evacuated during the war and barred from returning to their homes. Japanese dissatisfaction was somewhat alleviated by these and other steps (such as flying the Japanese flag in the Ryukyus on Japanese holidays), but the status of the two island groups remained a source of considerable friction with the United States.

Demands for the return of the Soviet-occupied Kuril Islands were even less successful; they were, in fact, the chief cause of the failure of the negotiations for a peace treaty in 1955-1956. According to numerous public opinion polls, a majority of the Japanese felt that Japan had a right to recover not only the Kurils, but also southern Sakhalin (taken from Russia in 1905),

and preferred to do without a Soviet treaty rather than abandon these claims. In the face of Soviet obduracy, the Japanese government offered to forgo southern Sakhalin and the northern half of the Kuril chain. The USSR would offer only the Habomai Islands and Shikotan Island, and these only if Japan formally recognized Soviet title to all the rest. Japan refused these terms, and argued that these southern islands were not part of the Kurils, but had always been Japanese. Diplomatic relations between Japan and the USSR were restored in 1956 without a resolution of the territorial issue. In 1961 the USSR announced that it would keep the Habomai Islands and Shikotan until Japan abrogated its alliance with the United States and accepted Soviet terms for a peace treaty.

Japan's International Position.—The intense desire of Japan to pursue an independent foreign policy after 1952 proved hard to achieve. Relations with its nearest neighbors remained uneasy. The USSR and China alternately threatened and cajoled a Japan torn between fear that alliance with the United States might provoke a Communist attack, and fear that lack of an alliance would lead to absorption as a Communist satellite. Repeated efforts to negotiate a settlement of bitter disputes with South Korea (chiefly over property claims and fishing rights) were unsuccessful, although relations improved noticeably after the ouster of President Syngman Rhee in April 1960.

Because of the weakness of South and Southeast Asian economies and the pressure of European competition, economic diplomacy produced no startling improvement in Japan's role in this area. There was, however, a marked improvement in the country's commercial reputation throughout the world, and economic ties, much more than military alliance or ideological conviction, bound Japan tentatively to the anti-Communist coalition. Election to the United Nations Security Council for the 1958-1959 term gratified national pride, but many Japanese found it difficult to accept their country's greatly reduced role in world affairs. In February 1961, the Japanese ambassador to the United Nations advocated the sending of Japanese contingents to the United Nations forces in the Congo and the Middle East in order to strengthen Japan's voice in the world body. This proposal was hastily repudiated by his government, which was acutely aware of the strong public opposition to the dispatch of Japanese troops abroad. Yet, as one of the most populous and energetic nations in the world, Japan hoped to achieve a new role of leadership in Asia.

Relatively rapid economic recovery after World War II showed that the Japanese still possessed the will, energy, skills, and resourcefulness that had made them Asia's first industrialized nation. This suggested that Japanese experience might be at least partially applicable to some of the problems facing other Asian countries. Japan perhaps tended to underestimate the difficulties involved in translating this potential connection into either economic or political leadership. Both India and Communist China now also aspired to Asian leadership, and Chinese policy in particular seemed certain to exert a strong influence on political and economic developments in Asia. More than prestige and national pride were involved in the competition; Japan found that it had a vital economic stake in improving relations with other countries, especially in Asia. The rise of Communist China and Japan's shift from militarist to pacifist policies clearly marked the end of an era in the continent, but the Japanese remained cautiously optimistic about their ability to cope with the new situation.

See also FAR EASTERN AFFAIRS—World War II and Thereafter; WORLD WAR II—15. The Postwar World (Later Developments).

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NOTE: The foregoing 23 articles on Japan were prepared under the joint direction of the editors of THE ENCYCLOPEDIA AMERICANA and Dr. Hugh Borton, professor of Japanese and director of the East Asian Institute, Columbia University, and later president of Haverford College.

JAPAN, Sea of, a basin of the Pacific Ocean, situated between the Japanese islands and the continent of Asia. With a maximum width of approximately 650 miles and a maximum length of 1,000 miles, it has an area of almost 400,000 square miles. Depths of 14,000 feet occur north-east of the Noto Peninsula and east of Okushirishima. During the ice age, when the ocean level was lower, the Japanese islands were connected to the continent by dry land, and the sea was restricted to a much smaller freshwater lake.

The Tsushima Current, a branch of the warm Kuroshio (Japan Current), enters the sea through the Tsushima and Korea straits and follows the coast of Honshu northward. Some water from the Tsushima Current eventually finds its way back into the Pacific through the Tsugaru and La Pérouse (Soya) straits. The Sea of Japan coast

of Honshu is warmed by the current, but heavy snows result when winter air masses from the continent are warmed before they strike the coast. The cold Liman Current flows southward along the continent and chills its coast. Drift ice is carried by the Liman Current from January to April.

The principal ports on the Sea of Japan are Vladivostok and Sovetskaya Gavan in the USSR; Otaru, Niigata, Maizuru, and Tsuruga in Japan; and Hungnam, Chongjin, Najin, and Wonsan in Korea. Because of overfishing, the importance of the sea's fisheries has declined.

C. A. MANCHESTER, JR.

JAPAN CLOVER or JAPANESE CLOVER or HOOPKOOP, one of the bush clovers (*Lespedeza striata*) in the pea or bean family, Leguminosae. Native to China and Japan, it was introduced into the southern United States before the middle of the 19th century. Its range now extends from New Jersey westward to Indiana and south to Florida and Texas. The plant is a spreading annual, growing to a height of a foot or more, with small trifoliate leaves less than an inch long and with rather inconspicuous, pink to purplish or white, beanlike flowers about a quarter of an inch in length. The flowers are developed singly or in small clusters in the axils of the leaves, and some of them are without petals. The fruit is a minute, one-seeded pod.

Japan clover has spread extensively in the United States. It is undemanding, grows readily in relatively poor and dry soil, and serves as a pasture plant, as hay, and as green manure. It is closely related to the Korean lespedeza (*L. stipulacea*), which has also been introduced into the United States and has spread widely.

EDWIN B. MATZKE.

JAPAN CURRENT. See JAPAN, SEA OF; KUROSHIO or JAPAN CURRENT.

JAPANESE AIR PLANT or JAPANESE AIR FERN, a marine exoskeleton widely sold for decorative purposes. Despite its name, it is not an air plant (epiphyte), but the dried, prepared, and dyed exoskeleton of a colonial marine animal (*Thuriaria cypressina*) belonging to the phylum Coelenterata (hydroids, hydromedusae, jellyfishes, sea anemones, corals). This animal is also known as sea cypress or, in the British trade, as sea moss. It is common along both shores of the North Atlantic Ocean and is regularly harvested in the Thames Estuary. A related species, *T. argentea* or squirrel's tail, is found in the eastern Pacific Ocean from Alaska to San Francisco Bay. Its silvery colonies are often washed ashore by storms. The plantlike colonies, 12 inches or more in length, are attached to rocks with a rootlike base and are profusely branched, the branches bearing hundreds of minute hydranths (feeding polyps) and occasionally larger reproductive polyps (gonangia). The stems (hydrocauli) are made up of the transparent, chitinous perisarc and the internal hollow coenosarc through which digested food passes from polyp to polyp.

THEODOR JUST.

JAPANESE BEETLE, an insect (*Popillia japonica*) accidentally introduced into New Jersey from Japan, probably in the larval form in soil around nursery stock. First found in 1916 near Riverton, it is now widely distributed along the

Atlantic seaboard from Massachusetts to South Carolina and west at scattered points through much of the Midwest.

The adult beetle is shiny brown and green with 12 white spots along the sides. It is about $\frac{1}{2}$ inch long and about $\frac{1}{4}$ inch wide. There is a single generation each year. Most of this time is spent by the insect in the soil as egg, larva, and pupa. The female lays a total of from 40 to 60 eggs beginning a few days after the adults emerge from the pupae in the soil about the middle of June. These eggs are laid a few at a time at a depth of from 2 to 4 inches.

The small white grubs live in the ground feeding upon plant roots, often causing serious damage to turf in lawns, parks, pastures, golf courses, and other turf areas. In the winter they go down to a depth of from 4 to 8 inches for protection from the cold.

The adults feed upon and do much damage to 275 different plants at the last count, including most of the economic crops. They show much preference for grape, raspberry, rose (foliage, buds, and flowers), Virginia creeper, dahlia, hollyhock, marshmallow, zinnia, clover, corn, soybean, apple, peach fruit, cherry, elm, horsechestnut, linden, Lombardy poplar, Norwegian maple, and willow. It is estimated that altogether \$10 million damage is done yearly by both larva and adult to farm and orchard crops, lawns, golf courses, and to ornamental plantings.

Control measures against the adult consist of protecting the foliage with sprays made from 50 per cent wettable DDT powder, lead arsenate, or powdered derris. Lawns are protected from injury by the larvae for at least six years with one application of DDT, for three years with one application of chlordane, and indefinitely with one application of milky spore disease dust. The latter, however, usually takes two or more years to become fully effective.

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JAPANESE CERAMICS. The skill of the Japanese as ceramicists has been known to the Occidental world since shortly after 1542 when a Portuguese ship went ashore at Tanegashima, the southernmost point of the Nippon "home islands." This accidental landing brought the first Europeans to Japan. Fairly soon thereafter, Western trading ships began calling at Nagasaki and taking back to Europe various Japanese products, including ceramics. Portugal was the first, with Spain and the Netherlands close seconds. For nearly 80 years, under the earlier Tokugawa shoguns, all were welcome. During this period strife developed among these Western foreigners which resulted in the Spaniards being expelled in 1624, and the Portuguese in 1638. The Dutch were permitted to stay but were obliged to trade under the most restricted conditions. They were allowed one trading post or factory which was located on Deshima, a small island in the harbor of Nagasaki. Further, the number of trading vessels was rigidly limited. But though the conditions were humiliating, and the men stationed there were virtual prisoners, the Dutch found this trading monopoly very profitable.

The situation continued for over 200 years, or until Commodore Perry's visit in 1853 reopened Japan to foreign trade. During these two cen-

turies of self-imposed isolation, a considerable amount of Japanese ceramics arrived in Europe through the medium of the single Dutch trading post where these wares had a marked influence on Occidental potteries and porcelains. In Holland, examples in underglaze blue were copied by the potters of Delft. At the Meissen porcelain factory the finely decorated pieces done by Kakiyemon were studied and carefully copied, resulting in the Kakiyemon decorations for which Meissen was famous. These in turn were copied by contemporary French factories as well as by Chelsea and various other English porcelain producers.

Another Japanese porcelain, made solely for export, was of great influence, especially on Worcester and Derby china. Known as the Imari or Japanese pattern, many handsome dinner services were produced by both factories during the late 18th and early 19th centuries. This Japanese Imari porcelain was also the inspiration for the Staffordshire "gaudy Dutch." But though their ceramics and the artistry with which they were decorated had a powerful impact on European porcelains and earthenwares, practically nothing was known about how or where they were made until the Paris Exhibition of 1867. At this, the Japanese display included fine examples of antique earthenwares and porcelains. They attracted attention and since then have been studied extensively. As the result, it is now known that there were potteries making earthenware in at least 24 provinces and that the production of porcelains was carried on in some 6 different provinces. Not any of these, previous to the industrialization of Japan in the second half of the 19th century, were extensive establishments, like that at Ching-te-Chen (Fowliang since 1931) in China. They were small ventures, built around the accomplishments of some master of the potting arts or some gifted amateur and made possible by the patronage of an important feudal lord.

In some instances, like the pottery at Seto in the old Province of Owari, the venture was continued by gifted descendants of the founder for generations and each one was known by the same name, as Toshire I, Toshire II, Toshire III, etc. In others, as happened at the Karatsu pottery in Hizen Province, the nucleus might consist of a group of Korean potters brought back to Japan by officers in the army of the great conqueror Toyotomi Hideyoshi (1536-1598).

As far as the Japanese were concerned, porcelains ranked a poor second to the finest of their earthenwares as works of art. As with the Imari, their porcelains were often made for export and shaping and decoration were studied attempts to approximate what Japanese potters and decorators thought were the European tastes. In fact, after the Western industrialization of Japan was firmly established and large ceramic factories were built in the larger cities, such as Kobe, Tokyo, and Osaka, quantities of earthenwares and porcelains were produced in the Japanese manner but adapted for foreign trade.

Although the Japanese are considered by many Occidentals as one of the most gifted pottery-making people in the world, their actual accomplishments in that art were all based on borrowings from, and copying of, the achievements of Asiatic mainland neighbors, the Chinese and Koreans. Further, the special provenance or origin of a given piece of Japanese earthenware

or porcelain is by no means easy to determine. From about 1250 on and especially during the 18th and 19th centuries, the various Japanese potteries continuously copied each others' wares and decorative designs. In addition, some of the highly regarded wares of previous generations were reproduced at other places and so cleverly done that today experts are sometimes at a loss as to whether a specific example was made at the place where it originated or is a later revival, made elsewhere by a master potter who was an admirer of the older ware.

Then too, with the introduction of porcelain making about 1650, some of the better-known potteries produced both earthenware and the newer porcelain. Those in or near Kyoto, especially, made stonewares and porcelains in considerable variation. A large proportion of collectible antique wares were marked but the copying habit was present even here. Not only were the marks of potteries and master potters copied by others but even some of the master potters at times marked their pieces with Ming and other established Chinese marks. Therefore a Japanese ceramic mark is not always reliable proof of origin. Also, the identities of some of the best Japanese ceramic craftsmen are obscured because of their custom of using either their family name or totally different art names. An example is the Taizan family, long active in potting at Kyoto. Beginning about 1680, they used the art name of *Yohei* and later, during the 18th century, changed to *Baiki*. Finally, not all of the wares were always decorated at the pottery where they were made. Some were sent as blanks to such cities as Tokyo where there were large decorating shops, similar to those of Canton where so much of the Chinese porcelains intended for exportation was decorated.

Unlike the Chinese, the Japanese were not established workers in ceramics before the start of their recorded history. Nevertheless, there are evidences that some Nipponese pottery was made as early as the 1st century B.C. and continued for some five or six centuries. These earliest examples were small unglazed figures of horses, boats, men in armor and the like. Their discovery occurred in the course of excavating grave sites that antedate 700 A.D. These rude and crude burial pieces are considered by experts to show strong Chinese or Siberian influences. They are the first indication that the art of pottery making reached Japan from the Asiatic mainland and was not indigenous to the home islands of Honshu, Shikoku, Kyushu, and Hokkaido.

After 700 A.D., broadly taken as the beginning of recorded pottery making in Japan, some useful earthenware pieces were made in Nippon potteries located here and there. Judging from the limited number of examples still extant, these closely resembled Chinese pottery of the T'ang period and undoubtedly at first were the work of Chinese craftsmen. During the 8th and 9th centuries, there were sizeable migrations from China to Japan of potters as well as Buddhist priests. During this two-century span the Japanese liberally adopted Chinese culture, customs and literature. As a result, the earthenware with mottled glaze then made in Japan closely resembled, if it did not copy, that made in China.

Following this, there were no outstanding developments in Japanese pottery throughout the Early Heian (784-897) and the Late Heian (897-1184) periods save that the Nipponese potters

made their wares with a marked ornateness and elaboration and began to use some gilding. Buddhist religious figures with multiple pairs of arms and ornate decoration characterized Japanese pottery and native artistic restraint so apparent in later ceramics was completely lacking.

With the Kamakura period, which lasted for close to two centuries (1185-1333), the culture of the Sung dynasty that ruled China from 960 to 1279 A.D. became manifest in Japanese ceramics and continued to make its influence felt for close to another century. This was the time of Kato Shirazamon, first outstanding native potter. About 1223 a priest named Dogen is believed to have taken him to China to study the work of potters of the Sung period, then more popular in Japan than they were at home. In time this student potter returned, became known as Toshiro I and began to put in practice what he had learned. He established a pottery in Owari Province. Here, working with a purplish clay brought from China, he produced thin walled pieces that were turned on a wheel and finished first with an even brown glaze and then so covered by a black glossy one as to show streaks and spots. Later, Toshiro I had a pottery at Seto in the same province where he used native gray clay and finished the pieces with a reddish-brown underglaze and a brilliant black overglaze.

Such pieces are called Old Seto. The town itself was the first important pottery center. Here flourished his successors, Toshiro II and Toshiro III, who made the Old Seto ware, chiefly known from later pieces similar to it. They were followed by other masters who worked in Seto and nearby towns until the end of the 19th century. One of the towns was Nagoya, best-known for the work of the 19th century potter Oki Toyosuke. He originated an earthenware with a white opaque crackled glaze decorated with green spots.

Toward the close of this period or early in the Ashikaga (1338-1573) the tea ceremony became an established part of Japanese life. This too was of Chinese origin as the ancient tea testing competition in which individual tea bowls were wagered as to which dried first or remained moist longest after the tea in them had been drunk simultaneously by the owners. The Japanese changed this wagering contest into a formal ceremony, governed by strict rules of behavior, which is still a vital part of their social life. The host generally does not invite more than four guests. The ceremony is conducted in a small room about nine feet square, entered not from the house but from the garden. The door is so low that one enters on hands and knees. The tea ceremony equipment is always austere simple for the idea is to show the best of taste by using inexpensive materials. The individual parts may be of great age. All follow the designs established before the 16th century. Aside from the iron kettle in which the tea water is boiled, the iron chopsticks for handling the charcoal and the bamboo dipper for the hot water, the pieces are of stoneware. They consist of the brazier or *hure* over which the water is heated, a small jar for the powdered green tea, called a *chawe*, an incense box or *kogo*, a tray or *sara*, a water jar or *takatori*, and tea bowls, called *chawan*. The host serves each guest separately. A small amount of the powdered tea is put directly into the tea bowl and hot water added. The contents are then stirred with a

bamboo splint until it froths and the guest drinks his bowl of tea in three and a half sips, sucking it audibly to show keen enjoyment as well as showing the proper expression of delight. Throughout the ceremony, the water in the kettle is kept simmering to give the illusion of wind blowing through pine trees. There are no decorative accessories in the room other than a small tea screen, painted with a stylized landscape, and a few flowers arranged in a vase or single art object. The flower arrangement is placed on a little platform or *takanoma*, standing about six inches from the floor. Tea ceremony flower arrangements are designed to be used only once and young Japanese women spend a major part of their lives learning how to do them.

During the Momoyama period (1574-1602) came the Korean potters. Under the conquering general Hideyoshi, who rose from a humble groom to be Japan's military hero, Korea was subjugated and on their return a number of his generals brought with them trained Korean potters. These were settled under their patronage in various of the leading pottery towns. Here they soon introduced pottery shapes and wares that had been made for many years in their native land. Karatsu in Hizen Province was one of the important places where these Koreans were located. At first their pieces were probably pure Korean, including the *mishima* or inlaid type which the Japanese named *Oku-Korai* or Old Korean. Later, at the same place, these captive potters or their descendants developed several special wares known as *Chosen Karatsu*. One was made of blue-black clay and had a glaze resembling cast iron. Another with a green, black or brown glaze was streaked with an overglaze of olive green or white. There was also the painted Karatsu where the glaze was swiftly and crudely touched with strokes of brown or black overglaze.

Finally, there was a finer but similar ware produced for the princes of Hizen as presentation pieces. It was made of a fine yellow or brown clay, finished with a transparent crackle glaze combined with *mishima* inlay and called *Kenjo-Karatsu*. Other Korean potters were settled in Chikuzen Province. They made tea ceremony stoneware pieces with a dull brown, yellow or black spotted glaze and another ware having a golden brown glaze that was largely used for making ceremony tea jars. Still other Korean potters worked at Kyoto. One of them, Ameya, had a son named Chojiro who before his death, about 1610, was presented with a golden seal by the conqueror Hideyoshi. It was cut with the character *raku* meaning contentment. Chojiro developed his *raku* ware of a coarse, lightly fired clay shaped by hand into thick-walled bowls with carved or scraped surfaces. This ware was first glazed in black, then red or green and, finally, a straw yellow or even white. It was especially used for making tea bowls since it did not transmit heat readily. Many copies have been and still are being made of the *raku* ware. Members of the family are reported to be even now making it and marking it with the same presentation seal.

Satsuma, best-known of all the earthenwares, was also originated by a Korean working in Japan. The Prince of Satsuma (Saigo Takamori) was the patron of the pottery of the same name, located on the Island of Kyushu where Koreans had worked from sometime in the 15th

century. Toward the end of the 16th century, the then ruling Prince of Satsuma induced 17 more Koreans to come to work in his pottery. They soon scattered but not before one of them named Boku Heii discovered nearby deposits of a fine white clay. From it he made a finely crackled cream ware. Then, working with another potter, named Kanyu, from about 1640, the first white Satsuma resulted. It was a fine ware without decoration but covered with an ivory colored, very finely crackled glaze.

Most of this new ware was made at the nearby pottery at Tadeno in the same province and was also controlled by the prince whose name the ware has borne ever since. As these Korean workers left the Satsuma pottery, they took with them knowledge of how to make this special ware and in time it was produced in a number of different potteries, such as Chosa, Awata, and Ota. Old Satsuma stands foremost and surpassed all the other earthenwares. The pieces are small and the modeling fine. The color ranges from cream to old ivory but the glaze always has a very fine crackle. Later some of the pieces were decorated with raised ornaments and overglaze enamel colors. Brocaded Satsuma, so-called because the decoration simulates the design of a fine piece of silk brocade, was first made at the pottery in Chosa.

Other variations of Satsuma had the same crackled glaze but occurred in such colors as apple-green, straw-yellow, a pure black and sometimes black dusted with gold. In the 19th century, especially the latter half, examples of Satsuma or imitations of it were made for export. Artistically they rank very low since such ornaments as dragons, peacocks, the phoenix and human figures were added. These examples were largely produced in factories located chiefly in Osaka, Tokyo, and Kobe.

Besides the Korean craftsmen, there were a number of outstanding potters of native Japanese stock during the 17th century. The two who are best-known worked in Kyoto. Ogata Kenzan who lived from 1663 to 1743 was a potter, a poet, painter and master of the Tea Ceremony. He decorated his wares with flowers, landscapes, birds, trees and occasionally figures. His decorations were rendered with the fewest possible brush strokes and in a few simple colors. He was constantly varying his style and had many followers. The Japanese have always revered his work. Today there are collectors of Kenzan examples in all parts of the world though some of their pieces are "in the style of Kenzan" rather than genuine examples. The other great ceramic artist was Ninsei who worked about ten years some time before 1640. An artist and amateur potter, it is said that he could make any type of pottery though he is best known for his yellow or gray crackle glazed pieces with a circular mesh on which he painted flowers or ornamental patterns in red, silver, gold and other enamel colors, always simply done. Some pieces bearing his mark are still extant and are among the most costly of all Japanese ceramics.

In the 18th century the artistic quality of Japanese earthenwares began to deteriorate. Possibly this was because the best artists were modeling and decorating porcelains and those of artisan grade concerned themselves chiefly with making copies of the work of earlier masters. Consequently many 18th century earthenware pieces and most of those produced in the 19th

century fall far short of the artistic standards that had prevailed earlier and are generally ignored by well-informed collectors and museum curators.

JAPANESE PORCELAINS

Porcelains were not made in Japan until the beginning of the 16th century. The first Japanese potter to work in this ware was Gōrodayu go Shonzui who lived in Hizen Province. It is stated that he went to China and worked for five years in the potteries at Ching-te-Chen. Having learned all he could he returned home, bringing with him specimens of Chinese blue and white porcelain and a supply of the necessary kaolin and petuntse. On reaching home he produced a limited quantity of porcelain which closely resembled the Chinese but when his supplies were exhausted he had to stop work. Nothing further was accomplished until the opening years of the 17th century when a Korean potter named Risampeï who was settled in Hizen Province discovered deposits of kaolin and petuntse near Arita, another potting center in the same province.

Porcelain kilns were then established about 1610. First located at Hyakken, they were later moved to Arita to be near the source of supplies. It is believed that a limited amount of blue and white porcelain was made here but not until nearly 40 years later was porcelain making undertaken seriously, as the result of the initiative of Kakiyemon, great Japanese maker and decorator of porcelain mentioned earlier, and his companion Tokumon. They intended to go to China to learn the secrets of enamel colors but in Nagasaki the captain of a Chinese junk gave them the information and they returned to Arita. Kakiyemon soon perfected the beautiful type of decorating that is still known by his name and his porcelains not only became well-known in Japan but were used as models at Meissen and other European factories.

After this success at Arita other works were established at Nabeshima and Mikawachi, also in Hizen Province, which were under the control of such powerful feudal lords as the Prince of Nabeshima. At all three places a sizeable amount of fine porcelains were produced in a comparatively short time. Other porcelain factories sprang up in the provinces of Kyoto, Owari, and Kaga. They all tried to duplicate the porcelains of Hizen Province. Prince Maeda who controlled the pottery at Enuma in Kaga Province sent one of his master workmen, Goto Saijirō, to Arita to learn their secrets of porcelain making and decorating. He came back with the desired information and porcelains were made at Enuma from the latter part of the 17th century until about 1750. These are now called Kutani.

Early Japanese porcelains varied somewhat in the quality of body and glaze but modeling was always done with restraint and decorations were either delicately drawn designs done underglaze in blue or with overglaze enamels handled in excellent good taste. Since the Japanese greatly admired the Chinese celadon wares, these were often used as models for porcelain shapes.

The dominant characteristic of Japanese porcelain was its reticence of coloring and design. The composition of decoration always had high artistic merit and was kept well within bounds. Consequently decorative exuberance was virtually unknown except for the Imari ware which was

made for export. With this the decoration was planned and executed to adhere to the suggestions of Dutch traders. Popularity of Imari pieces when they reached Europe indicates that these traders knew the European taste of the time better than some present-day experts who have little good to say about Imari ware.

In general all Japanese porcelains of the 17th, 18th and early part of the 19th centuries were of a very hard paste. The glaze had a slightly bluish tint and decorations were striking and effective in color and design. Figures and landscapes were seldom used; those often employed were the crane, symbol of prosperity, the tortoise for longevity, the lion for valor and other animals, birds and fish, all were delineated with great simplicity. Flowers and trees were frequently used as decorations carefully posed and executed. In addition to blue used for underglaze decoration, the chief colors of overglaze enamels were a thick opaque Indian red, a light tone of yellow, sometimes with a grayish tinge and a green that tends to have a bluish cast. Another distinguishing mark whereby Japanese antique porcelains can be recognized are the three slightly rough spur marks found on the underside of each piece. These were caused by the spurs or thin rods of clay on which the pieces rested during firing.

Besides the usual porcelain, Japanese factories also produced very thin eggshell porcelain. It was first made at Mikochi in Hizen Province where it was decorated with underglaze blue. It was later made elsewhere and in the 19th century was decorated with figures of women and warriors done usually in gold, red and blue. These figures are sometimes covered by a very fine network.

The artistic quality of porcelains was maintained throughout the 18th and well into the 19th centuries. Among the outstanding artists who decorated porcelains after 1800 were Rokubei, father and son of Kyoto; Zengoro, also of Kyoto, whose reputation rests on his gold brocade and gold pattern on red ground, considered in Japan as among the most precious; Tamikichi of Seto in Owari Province who was backed by the Prince of Owari and had a number of fine decorators working under him. Also there was the important factory at Enuma in Kaga Province which suspended in 1868 but reopened and by 1885 employed some 2,700 workers. Of the well-known factories, that at Arita is reported to have resumed operation under the United States occupation of Japan and is again making fine quality porcelain, more for export than for home consumption.

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JAPANNING, the art of giving a brilliant finish to a surface by applying several coats of varnish, dried and hardened so as to be fixed. The article to be japanned is first brushed over with two or three coats of priming. It is then covered with varnish, previously mixed with a pigment of the tint desired. This is called the ground color; and if the subject is to exhibit a design, the objects are painted upon it in colors mixed with varnish, and used in the same manner as for oil-painting. The whole is then covered with additional coats of transparent

varnish, dried or baked on and polished. The process is subject to considerable variations, being a combination of painting and partial enameling. See LACQUERS, INDUSTRIAL; VARNISH.

JAPHETH, jā'fēth, a son of Noah and progenitor of the branch of the human race called Japhetic, born when his father had attained his 500th year (Genesis 5:32). For his act of filial respect to his father (Genesis 9:23-27) he received the latter's blessing and promise of future enlargement, when his descendants would extend over the world, and Canaan to be his as well as Shem's servant. Married before the Flood, he and his wife were saved in the ark. The birth of his seven sons occurred after the Deluge (Genesis 10:1). The name has been variously explained. According to Genesis 9:27, it is derived from an Aramaic root, signifying "to expand," in allusion to the wide expansion of Japheth's descendants in the west of Europe, and the north of Asia, including Armenians, Medes, Greeks, Thracians, and so forth. Others trace it to the root "fair," in reference to the light complexion of his posterity. The former derivation has most in his favor. Arab legend invests Japheth with wondrous powers, and mentions 11 of his sons as founders of as many Asiatic nations. But the gift of imagination was not given to rabbinical and Mohammedan writers alone. Some more modern authors seek to identify Japheth with the Iapetus (q.v.) of Greek fable (Margoliouth, G., in Hastings's *Dictionary of the Bible*), whose wife, Asia, bore Prometheus, civilization's founder. The word, too, has been loosely employed by some philologists in the term Japhetic or Indo-European languages, in contradistinction to Semitic and Hamitic. The homiletical tendencies of the rabbis are exemplified in the Midrashic comment on Genesis 9:1, when God blessed Noah and his sons. In blessing Japheth He promised that all his sons should be white and gave as their portion deserts and fields.

JAPIKS, jā'pīks, **Gijsbert**, Frisian poet: b. Bolsward, 1603; d. 1666. He was carefully educated and became a schoolmaster at Bolsward. He made translations from French verse and also wrote a number of versions of the Psalms. His original verse was exceptionally meritorious and did much to restore the Frisian dialect to its place in literature. His *Friesche Rymlerye* (1668), was edited by Epkema (Leeuwarden 1821; with vocabulary and grammar, 1825).

Consult Halbertsma, Joost and Eeltje, *Hulde aan Gijsbert Japiks* (Bolsward 1824; Leeuwarden 1827).

JARARACA, zhā-rā-rā'kā, venomous South American serpent of the crotaloid family, classified as *Lachesis jararaca*, *Bothrops jararaca*, and also as *Trimeresurus jararaca*, a closely allied species being the labaria, *Trimeresurus atrox*, from which it is almost indistinguishable. The jararaca ranges from the Amazon regions southward to São Paulo and westward to Peru and Ecuador. The color is grayish brown, spotted with darker brown above and gray beneath with longitudinal rows of whitish or yellowish spots. The bite is generally fatal.

JARDIN D'ACCLIMATATION, zhār-dān dā'klē-mā-tā-syon', Paris, a plot of 50 acres in the northwest angle of the Bois de Boulogne devoted to the acclimatization of foreign plants

and animals. It was founded in 1860, and contains more animals, except beasts of prey, than the Jardin des Plantes. It has also a permanent exhibition of the processes and equipment of a dairy, aviary, greenhouses, poultry and carrier pigeon raising and gardening, and there is a winter garden and an aquarium. It forms a popular resort for pleasure and information.

JARDIN DES PLANTES, zhār'dān dā plānt, Paris, a plot of 74 acres originally known as the Jardin du Roi, founded by Gui de La Brosse, physician to Louis XIII in 1635 as a garden for medicinal herbs. After the appointment of Georges Louis Leclerc, comte de Buffon as director, in 1739, the menagerie, galleries of collections, libraries, laboratories and lecture-rooms were established there and since 1794 it has been known as the Museum d'Histoire Naturelle.

JARDIN MABILLE, zhār'dān mā'bēl', Paris, a popular resort of the demimonde founded by a dancer, Mabile, in 1840 and continuing one of the showplaces of the city until its close in 1875. It was celebrated for its beautiful fittings and for its originations in dancing.

JARDINE, jār'din, **William M.**, American agronomist: b. Oneida County, Idaho, Jan. 16, 1879; d. San Antonio, Texas, Jan. 17, 1955. Graduated from Utah State Agricultural College in 1904, he taught agronomy there for two years, and in 1907 was appointed assistant United States cerealist in charge of dry-land grain investigations. In 1910 he accepted a post as agronomist at Kansas State College of Agriculture, where he became dean of agriculture in 1913 and president of the college in 1918.

In 1925, President Calvin Coolidge appointed Jardine secretary of agriculture. He expanded the department by establishing a cooperative marketing division as a research bureau to aid in the organization of cooperative farm projects, and sponsored a program for the development of farmer-owned commodity cooperatives to be governed by a Federal Farm Board. Leaving office with Coolidge in March 1929, he was appointed minister to Egypt by President Herbert C. Hoover in July 1930, remaining until 1933. After a brief period as state treasurer of Kansas, he became president of the Municipal University of Wichita, serving from 1934 to 1949. He was the author of many papers and bulletins in the fields of education, economics, and agriculture, and a fellow of the American Association for the Advancement of Science.

JARNAC, zhār-nāk', France, town in the department of Charente, on the river Charente, 18 miles west of Angoulême. It has a large trade in brandy and wine and manufactures wine casks. It was the scene, March 13, 1569, of the defeat of the Huguenot forces under Louis, Prince of Condé and Gaspard de Coligny by the Catholics under Francois, Duke of Anjou. Pop. (1946) 4,075.

JARNEFELT, yār'nē-fēlt, (**Edvard**) **Armas**, Finnish composer: b. Viborg, Aug. 14, 1869. He studied under Martin Wegelius and Ferruccio Busoni at the Conservatory at Helsingfors, under Jules Massenet at Paris and A. Becker at Berlin. He became conductor of the theater at Magdeburg in 1897, at Düsseldorf

in 1898, and was conductor of the Viborg orchestra from 1898 to 1903. He then conducted opera at Helsingfors (1903–1907) and at Stockholm (1907–1932), becoming court conductor also in Stockholm (1910). He returned to the Helsingfors opera (1932–1936), and led the municipal orchestra there (1942–1943). In addition to orchestral and choral works, instrumental music, and songs, he wrote incidental music for plays and motion pictures.

JARO, hǎ'rô, municipality, Republic of the Philippines, in Leyte Province on Leyte Island. It lies in a mountainous agricultural region 15 miles west of Tacloban. Rice and coconuts are the chief crops. Pop. (1948) 19,650.

JAROSLAW, yǎ-rô'slăf, town, Poland, in Rzeszów Province, on the San River, 16 miles north of Przemyśl. Its chief manufactures are flour, metalware, cement products, lumber, and bricks. Part of Poland in 1382, it passed to Austria in 1772, and was returned to Poland in 1919. Pop. (1946) 19,376.

JARRAH, jǎr'ă, the common name of a tree, *Eucalyptus marginata*, of the myrtle family (Myrtaceae), native to Western Australia. It reaches a height of 50 to 150 feet, and has a subfibrous bark which is persistent up to the small branches. The juvenile leaves are opposite for several pairs, oblong to ovate, and short-petioled, whereas the mature leaves are alternate, petiolate, narrowly to broadly lanceolate and acuminate, usually with thickened margins. The white flowers are in axillary umbels of from four to eight, appearing irregularly from September to February. The red timber of this tree is one of the best for many purposes, being very durable as a structural timber either above or below ground or in water. It is reputedly resistant to attacks by termites, mice, and shipworms, and is widely used for marine pilings.

RICHARD M. STRAW.

JARROW, jǎr'ô, municipal borough, England, in Durham County, on the Tyne, 5 miles east of Newcastle. A shipbuilding center from 1851, it has foundries as well as factories producing machinery, chemicals, electrical equipment, and paper. The parish church, St. Paul's, incorporates parts of a basilica founded in 685, and the Venerable Bede (673–735) spent most of his life in the nearby monastery of Wearmouth and Jarrow. Pop. (1951) 28,635.

JARVES, jǎr'vēs, Deming, American glassmaker: b. Boston, Mass., baptismal date Dec. 9, 1790; d. there, April 15, 1869. In 1817, Jarves and others bought the Crown Glass Company of Cambridge, Mass., renamed it the New England Glass Company, and began the manufacture of flint and crown glass. At that time English glassmakers controlled the American market through their monopoly of secret formulas for making litharge (red lead). Jarves built experimental furnaces and succeeded in compounding litharge, thus enabling American firms to compete with English manufacturers. About 1824 he broke with his partners and opened a factory at Sandwich, Mass., which began making glass on July 4, 1825. The company was incorporated in 1826 as the Boston and Sandwich Glass Company, and made apothecary glassware, table glass, chandeliers, and

lamps. Jarves left that firm in 1858 and established the Cape Cod Glass Company nearby, which came to an end with his death in 1869. He published *Reminiscences of Glass Making* (1854). See also CAPE COD—History.

JARVES, James Jackson, American art collector: b. Boston, Mass., Aug. 20, 1818; d. Tarasp, Switzerland, June 28, 1888. The son of Deming Jarves, he left school at 16 and traveled extensively. In Honolulu in 1840 he founded and edited the weekly *Polynesian*, later the official organ of the Hawaiian government. About 1850 he settled in Florence, Italy, and was one of the first Americans to collect and write about early Italian painting. He placed his collection of 119 paintings in the new art school at Yale University shortly after 1866, and the university bought these at auction in 1871. Most of a later collection of 52 paintings found their way to the Cleveland Museum of Art. He gave his valuable collection of Venetian glass to the Metropolitan Museum of Art, New York City, in memory of his father, and Wellesley College acquired his collection of laces, embroideries, and Renaissance fabrics.

JARVIS, jǎr'vīs, Edward, American physician: b. Concord, Mass., Jan. 9, 1803; d. Dorchester, Oct. 31, 1884. He graduated from Harvard in 1826 and from the Massachusetts Medical College in 1830. He set up practice in Northfield, Mass., later in Concord, Mass., in Louisville, Ky., and from 1843 in Dorchester, where he was particularly successful in treating insanity. His interest in anthropology and vital statistics led him to a close study of the census, and his suggestions for improvements in census procedure were largely adopted. He gave his valuable statistical library, one of the best in the United States, to the American Statistical Association, of which he became president in 1852.

JARVIS, John Wesley, American portrait painter: b. South Shields, England, baptismal date July 1, 1781; d. New York, N.Y., Jan. 14, 1839. His parents emigrated to the United States soon after his birth, leaving him in the care of his uncle John Wesley, the founder of Methodism. When he was five years old he was taken to Philadelphia to join his family. As a schoolboy he worked for the portrait painter Matthew Pratt and other artists, and was later apprenticed to the print publisher Edward Savage, who moved his shop to New York City in 1800. His apprenticeship completed, Jarvis and Joseph Wood opened a studio in New York, painting miniatures and profile portraits on glass. Jarvis soon opened his own studio and was especially successful with portraits painted on Bristol board, as well as with miniatures on ivory and portraits in oil. Thomas Sully was his assistant in 1807, and later (1816–1823) Henry Inman became his apprentice and assistant. With Inman's assistance he completed as many as six portraits a week, painting such notables as Henry Clay, DeWitt Clinton, James Fenimore Cooper, Fitz-Greene Halleck, James Lawrence, Robert Morris, and Thomas Paine. The leading portrait painter of his day in New York, he made a large income, but lived excessively, became a hard drinker, and died in poverty. In the 1830's he painted a series of full-length portraits of the heroes of the War of 1812 for the New York City Hall and a series of portraits

owned by the New York Historical Society.

JARVIS, Thomas Jordan, American statesman: b. Jarvisburg, Currituck County, N.C., Jan. 18, 1836; d. June 17, 1915. He worked his way through Randolph-Macon College, enlisted in the Confederate Army at the outbreak of the Civil War, and, when he was disabled in 1863, had become a captain in the 8th North Carolina Regiment. After the war he studied law, began practice in 1867, and in 1868 was elected to the state legislature. Elected lieutenant governor in 1876, he served as governor upon the resignation of Gov. Zebulon Baird Vance in 1879, and in 1880 was elected to a full term, proving to be an able and courageous executive. From 1885 to 1889 he served as United States minister to Brazil, and in 1894 was appointed to the Senate to fill a vacancy of one year.

JARVIS ISLAND, one of the Line Islands in the Pacific Ocean. It lies just south of the equator, 190 miles southwest of Christmas Island, and has an area of one square mile. Claimed by the United States in 1857, it was worked for guano until 1879, and in 1889 was claimed by Great Britain. In 1935 it was colonized from Hawaii, and in 1936 was placed under the United States Department of the Interior. It lies on the air route from Hawaii to New Zealand and has a weather station and a landing field. For census purposes the island is included with the Territory of Hawaii.

JASHAR, or JASHER, jā'shēr, *Book of*, a lost book of ancient Hebrew national songs, probably both religious and secular. It is mentioned by name twice in the Bible (Joshua 10:13; II Samuel 1:18), where passages from it are quoted in the song of Joshua and in David's lament over Saul and Jonathan. The song of Deborah (Judges 5), Solomon's speech dedicating the Temple (I Kings 8), and possibly some other passages in the Old Testament may also quote from this source. The book was probably not completed before the time of David or of Solomon and the building of the Temple (about 960 B.C.). The etymology of the word *Jashar* (Heb. *Haya-shar*) is uncertain; it may derive from a word meaning "victorious," or from one meaning "song," or one meaning "sing." It has also been translated "upright" on the assumption that it had the same root as *Jeshurun*. Most Jewish commentators accept the Targum "book of the law," on the theory that the events mentioned in the fragments quoted in Joshua and II Samuel constitute a fulfillment of passages in the Pentateuch.

JASMIN, zhās-măn, **Jacques**, pen name of JACQUES BOÉ, French poet: b. Agen, France, March 6, 1798; d. there, Oct. 4, 1864. He was also known as *Jasmin d'Agen* and as the Barber Poet, and was called the last of the troubadours. A wigmaker by trade, he devoted his leisure to reading and study and developed a talent for composing poems and songs in the Gascon dialect surviving from the old *langue d'oc* of southern France. He went from town to town reciting his poems at fairs and carnivals, and gave most of the money he received to charity. People came in crowds to hear him. His first book of poems, *Las papillotas* (*Curl Papers*), was published in 1835 and was followed by three others with the

same title in 1842, 1851, and 1863. Especially popular were his poems *Lou chilibari* (*Le charivari*, 1825), *L'abuglo de Castel-Culie* (*The Blind Girl of Castle Culier*, 1835), and *Françouneto* (1842). When Jasmin visited Paris in 1842, Louis Philippe gave a reception in his honor, and in 1846 he was made a chevalier of the Legion of Honor. The Académie Française crowned his works, and he was honored by Toulouse University and the pope. His works furthered the revival of Provençal literature by the Félibrige (q.v.), although he never regarded himself as one of them.

JASMINE, jās'mīn; jǎz'mīn (also called JASMIN and JESSAMINE), the common name for members of the genus *Jasminum*, comprising about 200 species of erect or twining shrubs in the olive family (Oleaceae), distributed throughout the tropics and subtropics of the world. The opposite or alternate leaves are usually pinnately compound, but are sometimes reduced to a single leaflet. The flowers are generally showy and fragrant, of yellow, white, or reddish colors, mostly disposed in terminal clusters or occasionally solitary. The bell- or funnel-shaped calyx has from four to nine bristly teeth, and the deeply tubular corolla has as many spreading lobes. The two stamens are short and included within the tube. The fruit is a two-lobed berry, usually black, each lobe of which contains one or two seeds.

About 25 species are in cultivation; they are easily cultured, but vary from hardy to hothouse types, and their requirements must be met. The common or poet's jasmine, *J. officinale*, is a deciduous shrub with long, weak stems and fragrant white flowers $\frac{3}{4}$ to 1 inch across, borne in loose clusters. It is native to regions from Iran to China and India. Perfumes are made from its flowers, and a large-flowered form is cultivated extensively in southern France for this purpose. The winter-blooming *J. nudiflorum* is a Chinese species.

Several other plants are also called jasmine. The box jasmines are members of the genus *Phillyrea*, also of the olive family, with three or four species native to the Mediterranean-Black Sea region. The Cape jasmines are members of the genus *Gardenia* of the madder family (Rubiaceae), with some 80 species of evergreen shrubs native to tropical Asia and Africa. *Androsace chamaejasme* of the primrose family (Primulaceae) is called rock jasmine. The Carolina, yellow, or false jasmine, *Gelsemium sempervirens*, is a climbing or trailing vine in the logania family (Loganiaceae) native to the southeastern United States; an antispasmodic drug is derived from its rhizomes.

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JASON, jā'sūn, Jewish high priest from c. 174 to c. 171 B.C. He was the second son of Simon II and a brother of Onias III, whom he succeeded as high priest through bribery. Flavius Josephus (37-?100 A.D.) says in his *Antiquities of the Jews* that he changed his name from Jesus to Jason. As high priest he set up a gymnasium and ephebeum at Jerusalem in which he introduced "heathenish and foreign" practices, and gained for the people of Jerusalem the title and privileges of citizens of Antioch. He furthered the spread of Greek secular and religious customs, sending to the Olympic games at Tyre a large sum of money for a

sacrifice to Hercules; the money was used, however, for building galleys. He was deposed about 171 B.C., Menelaus succeeding him through bribery. In 170 B.C., while the ruler Antiochus Epiphanes was fighting in Egypt, Jason again seized power, but was expelled when Antiochus returned. He took refuge at Sparta, where he died miserably. His story is told in II Maccabees 4:7-26 and 5:5-10.

JASON, in Greek legend, the son of Aeson, king of Iolcus in Thessaly, a hero of ancient Greece, celebrated for his share in the Argonautic expedition, before which he had distinguished himself in the Calydonian hunt (see CALYDONIAN BOAR). He belonged to the family of the Aeolidae at Iolcus, and his instructor was the centaur Chiron, who educated many heroes of that time. (For his adventures in the Argonautic expedition see ARGONAUTS.) On his return to Iolcus with Medea as his wife, he avenged the murder of his parents and his brother by putting Pelias to death. But he was unable to retain possession of the throne, and was obliged to resign it to Acastus, son of Pelias, and flee with his wife to Corinth. Here they passed 10 years, until Jason, wearied of Medea, fell in love with Glauce (Creusa, according to some accounts), daughter of Creon, king of Corinth, married her, and put away Medea and her children. Medea, having revenged herself on her hated rival (see MEDEA), fled from the wrath of Jason in her car drawn by winged dragons, the gift of Helios, to Aegues, king of Athens, after she had put to death Mermerus and Pheres, her sons by Jason. According to some, Jason killed himself from grief; according to others he was reconciled to Medea; and still others relate that, after passing a miserable wandering life, he came to his death by accident when, while sleeping in the shade of his old ship *Argo*, part of the stern fell on him.

JASON OF CYRENE, a historian of the 2d century B.C., author of a history of the Maccabees in five books, written in Greek and no longer extant. Although probably Jewish, he may have been Greek. Nothing is known about him except that in II Maccabees 2:24 we are told that this Apocryphal book (see MACCABEES, BOOK OF THE—*Second Book*) is an abridgement of his history.

JASPER, jäs'pēr, city, Alabama, Walker County seat. It is situated in a farming, pine timber, and bituminous-coal-mining region, about 35 miles northwest of Birmingham, at an altitude of 338 feet. It is served by the Illinois Central, the St. Louis-San Francisco, the Alabama Central, and the Southern railroads, and has an airport. The chief regional farm products are corn, cotton, grain, beef, milk, hogs, poultry, and truck crops. The chief local manufactured products are lumber and food products, concrete pipe, asphalt, brassières, and golf bags. Walker Junior College is in Jasper. Settled in 1815, Jasper has a council-manager government. Pop. 10,799.

JASPER, unincorporated community, Alberta, Canada. It is situated at an altitude of 3,472 feet on the Athabaska River at its junction with the Miette, 236 miles west of Edmonton and 185 miles north of Banff. The headquarters of Jasper National Park, the town is reached by highway and

by Canadian National Railways, and has a variety of tourist accommodations, including Jasper Park Lodge. Pop. 2,360.

MAURICE J. BOOTE.

JASPER, city, Indiana, Dubois County seat. It is situated 45 miles northeast of Evansville, on the Patoka River and on the Southern Railway, in a farming, timber, and coal-mining area. Its manufactured products include office furniture and furniture hardware, aluminum sand castings, rubber and concrete products, veneers, lacquer, radio and television cabinets, guitar parts, wood dimensional parts, gloves, wall panels, and processed poultry. Pop. 6,737.

JASPER, city, Texas, Jasper County seat. Located about 60 miles northeast of Beaumont, in a pine timber and farming area, it is a shipping point for cattle and farm products, and has canneries, lumber mills, and some manufacture of wood products. Pop. 4,889.

JASPER, a nearly opaque cryptocrystalline variety of quartz, commonly red, yellow, brown, or gray, sometimes green or blue. It may be banded, and is then called striped or ribbon jasper. It takes an excellent polish, and has been used for ornaments. Jaspilite is a term applied to a rock consisting of bands of red jasper alternating with black hematite, bent and folded by metamorphism.

LEWIS S. RAMSDALL.

JASPER NATIONAL PARK, the largest (4,200 square miles) of the reservations set aside by the Canadian government as scenic and recreational parks. On the eastern slope of the Rocky Mountains, in the Province of Alberta, bordered on the south by Banff National Park, Jasper is noted for the grandeur and variety of its mountain, glacier, lake, and river scenery. The mountains in the park consist of roughly parallel ranges running from the southeast to the northwest. Part of the Columbia Ice Field lies within the southern part of the park. This is the largest body of ice outside the Arctic Circle, and from the ice cap issue numerous glaciers that give birth to rivers whose waters eventually find their way to the Atlantic, the Arctic, and the Pacific oceans. Eleven of the highest peaks in the Canadian Rockies are in the immediate vicinity of the ice field. The Banff-Jasper highway passes close to the tongue of the Athabaska Glacier. Located at the northern end of the park are Miette Hot Springs, with an outdoor pool. The park contains large numbers of all game animals native to the Rocky Mountains. Many of these animals may be seen from the highways and from park trails. Tourist accommodations of all types are provided within the park. In addition to summer recreations, the park is a center for winter sports. It takes its name from Jasper House, a fur trading post established by the North West Company in 1813 on the Athabaska Trail, at the northern end of Jasper Lake.

MAURICE J. BOOTE.

JASPER PLACE, town, Alberta, Canada. It is largely a residential suburb of Edmonton, which adjoins it on the east. An adjacent industrial area is served by a spur line of Canadian National Railways. Pop. 30,530.

MAURICE J. BOOTE.

JASPER WARE, a vitrified pottery bisque developed in England by Josiah Wedgewood (1730–1795). See WEDGEWOOD WARE.

JASSY. See IÄŞI.

JASTROW, jäs'trō, **Joseph**, American psychologist: b. Warsaw, Poland, Jan. 30, 1863; d. Stockbridge, Mass., Jan. 8, 1944. The son of Marcus Jastrow, he was educated at the University of Pennsylvania and Johns Hopkins University, and from 1888 to 1927 was professor of psychology at the University of Wisconsin. He did important research in the field of abnormal psychology and the development, analysis, and correlation of mental processes. His books include *Time Relations of Mental Phenomena* (1890); *The Subconscious* (1906); *Psychology of Conviction* (1918); *Keeping Mentally Fit* (1928); *Piloting Your Mind* (1930); and *The House That Freud Built* (1932). His syndicated articles and radio broadcasting did much to interest the layman in psychology.

JASTROW, Marcus (known also as MORRIS JASTROW), American rabbi and lexicographer: b. Rogasen, Posen (Poznań), Prussian Poland, June 5, 1829; d. Germantown, Pa., Oct. 13, 1903. He was educated at the universities of Berlin and Halle and, after serving as rabbi in Warsaw (1858–1863) and Worms (1864–1866), emigrated to Philadelphia, where he was rabbi of Congregation Rodeph Shalom until his death. He was one of the outstanding leaders of conservative Judaism. His most important published work was the scholarly *Dictionary of the Targumim, the Talmud Babli and Yerushalmi, and the Midrashic Literature* (1886–1903, reprinted 1926).

JASTROW, Morris, American Orientalist: b. Warsaw, Poland, Aug. 13, 1861; d. Jenkintown, Pa., June 22, 1921. The son of Marcus Jastrow, he was brought to the United States as a small child. Obtaining degrees from the universities of Pennsylvania (1881) and Leipzig (1884), he became an authority on Assyrian, Babylonian, and Hebrew religions and literatures. From 1891 he was professor of Semitic languages at the University of Pennsylvania, and from 1898 was also university librarian. Among the best-known of his many works are *The Religion of Babylonia and Assyria* (1898), later expanded in German as *Die Religion Babyloniens und Assyriens* (1905–1912); *The Study of Religion* (1901); *The Civilization of Babylonia and Assyria* (1915); *Zionism and the Future of Palestine* (1919); *The Eastern Question and Its Solution* (1920); and *The Book of Job* (1920).

JASZBERENY, yäs'bē-rân-y', city, Hungary, in Jász-Nagykun-Szolnok County, on the Zagyva River, 37 miles east of Budapest. Its Hungarian name is Jászberény. It is a market and shipping center for a farming area raising wheat, corn, tobacco, and livestock, and has a school of agriculture and a museum of folk art. Pop. (1941) 31,070.

JATAKA, jät'a-kä, a collection of 547 stories concerned with the various incarnations of the Buddha (see BUDDHA and BUDDHISM) antecedent to the famous historical one in which he attained enlightenment, described the Noble Eightfold Path, and set in motion the saving Wheel

of the Law. These stories are known to have been in existence by 380 B.C., and consist largely of an identification of the Buddha-to-be with the heroes—often bird, serpent, or animal—of fables and stories current in India at the time of the actual Buddha's death, if not for hundreds of years before. The stories are written in the Pāli language and form part of the Buddhist Hinayāna canon, whence, it seems, some of them crept into the Sanskrit Mahāyāna *Jātakamālā*, written by Āryaśūra (translated into English by Jacob Samuel Speyer as *Jātakamālā or Garland of Birth-Stories*, Oxford 1895).

Through his exercise of self-sacrificing love during hundreds of incarnations, the future Great Being became ever more expert in the Ten Perfections: goodness, generosity, renunciation, wisdom, patience, truthfulness, energy, resolution, kindness, and equanimity. He rose toward perfect manhood by, as a rabbit, saving the life of a starving hermit by leaping (but only after shaking himself free of precious insect life) into a stewpot which he had urged the ascetic to bring to the boil; by, as the king of a monkey tribe, rescuing his people, though at the expense of his life, from a band of hunters; and by, as a great six-tusked elephant, tearing from his bleeding body the ivory which had excited the rabid desire of a frivolous queen. In other words, the *Jataka* tells how he advanced to full Buddhahood both by positive benevolence and by nonresistance to evil.

Bibliography.—The collection was completely translated into English under the direction of Edward Byles Cowell, 7 vols. (Cambridge 1895–1913), while the ancient Pāli introduction entitled the *Nidāna-kathā or Story of the Lineage*, written about 440 A.D., was translated by T. W. Rhys Davids (Oxford 1880, new and revised edition by Caroline Rhys Davids, London and New York 1925).

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JATIBONICO DEL NORTE, Río, hātē-vō-nē'kō děl nōr'tā, river, Cuba. It originates south of Caibarién in Las Villas Province and flows along the Camagüey Province border for about 40 miles to the north coast. The Río Jatibonico del Sur runs southward to the Caribbean Sea, forming the border between the two provinces for about 60 miles.

JATIVA or **JATIBA**, hātē-vā (formerly XÁTIVA), city, Spain, in Valencia Province, 35 miles southwest of the city of Valencia. It is situated at an elevation of 365 feet on the Albaida River, and on the main railway line from Valencia to Alicante. The market, shipping, and industrial center of a fertile agricultural area producing oranges and rice, it has distilleries, a tannery, cement works, and paper mills, and also manufactures bicycles, linen, knit goods, leather goods, burlap, felt hats, soap, and toys. Founded by Phoenicians, who made it a linen-making center, it became the Roman colony of Setabis (or Saetabis). It fell to the Arabs in 714, was taken by James I of Aragon in 1244, and by Philip V in 1707. The city became the home of members of the Borgia (Borja) family in the 14th century. Pop. (1950) 18,092.

JATROPHA, jät'rō-fā, a genus of tropical and subtropical shrubs and small trees of the surge family (Euphorbiaceae). It includes some

75 American species, 50 from Africa, and a few from India and Arabia; one occurs on beaches in Florida. *J. curcas*, physic nut (q.v.), and *J. multifida*, coral plant, yield oils of economic importance. In addition, about 50 American species (three occurring in the southern United States) are treated by some as a separate genus, *Cnidoscolus*. These are distinguished by very poisonous stinging hairs; the best-known is *J. urens* (or *C. urens*), which with its close relatives is the *mala mujer* (bad woman) of Mexico.

H. W. RICKETT.

JATS, jätz, jôtz, the most numerous tribe or caste of peasant cultivators in the Punjab region (q.v., now divided between India and Pakistan), numbering over 5 million. They are found mostly near Amritsar in Punjab State in India and in the neighborhood of Lahore in West Pakistan, but are scattered throughout the Punjab region and in India extend also into Rajasthan. They are believed to be descended from the Saka, a branch of the Scythians, who entered the Punjab from Central Asia by way of eastern Iran between the 2d century B.C. and the 5th century A.D. The present Jats are skillful and industrious cultivators who usually own their own land; they work their small fields themselves with the aid of their womenfolk, rather than hiring labor. Often they supplement the farm income by engaging in trade. In the 20th century many migrated to Australia, Canada, and California in search of employment; on returning home with their savings, they have become farmer moneylenders.

Jats are famous as warriors; during World War I and after, they enlisted in the British Army in considerable numbers. Three religions are represented among them: Sikh, Hindu, and Muslim. Jats constitute the major group within Sikhism. Since the partition of India and Pakistan in 1947, the Muslims have been concentrated in Pakistan, the Hindus and Sikhs in India. There are also nomadic Jats in West Pakistan who are very like gypsies in appearance and behavior. They migrate from village to village in extended family camps, making and selling tambourines, sieves, and other articles.

ELIZABETH E. BACON.

JAU, zhà-ōō' (formerly JAHÚ), city, Brazil, in the State of São Paulo, 150 miles northwest of São Paulo city. Jau has an airfield and is a trading center for coffee, sugar, rice, potatoes, and livestock. Its chief industries are brewing, distilling, processing cottonseed oil and manioc, and manufacturing furniture and farm machinery. Pop. (1950) 44,141.

JAUNDICE, jôn'dis (ICTERUS), a yellowish discoloration of the skin, mucous membranes, eyes, and other tissues by the bile pigment, bilirubin. The bile pigment, a product derived from hemoglobin of red blood cells, is modified and excreted by the liver to form a component of bile. It is deposited in the tissues as a result of an excess in the blood (hyperbilirubinemia). Excess of bile pigment in the blood with diffusion into and staining of tissues may be a *retention jaundice*, either due to increased formation resulting from excessive destruction of red blood cells and beyond the excretory capacity of the liver (*hemolytic* or *acholuric jaundice*), or due to disease of the liver itself which prevents its adequate modification

and excretion (*toxic* or *hepatocellular jaundice*). A *regurgitation* or *obstructive jaundice* results from reabsorption of bile into the blood when the excretion of bile is prevented by obstruction of bile passages and ducts, either within the liver or in ducts beyond the liver which carry bile to the intestine.

Differentiation of the types of jaundice and determination of the underlying causative disease process is facilitated by observation of associated symptoms and by various laboratory tests. Bile pigment appears in the urine (dark urine) when jaundice results from disease of the liver or from obstruction of bile passages, but not when excessive breakdown of red blood cells (hemolysis) alone is the cause (acholuria). In obstructive jaundice, bile may fail in varying degree to reach the intestine and to color its content, so that stools are lighter in color or even clay colored. In jaundice associated with disease of the liver, a reabsorbed pigment product from excreted bile, urobilinogen, fails to be adequately handled by the liver and appears in excess in the urine.

Jaundice per se may have little deleterious effect, although it is sometimes associated with itching of the skin. In obstructive jaundice, absence of bile from the intestinal tract interferes with absorption of fat and fat-soluble vitamins, including vitamin K, deficiency of which may give rise to a bleeding tendency. A mild injury of the kidneys (cholemic nephrosis) may be associated with bile pigmentation. Pigmentation and damage to basal ganglia of the brain (kernicterus) may accompany severe hemolytic jaundice of newborn children. A slight and transient jaundice is common in newborn children, and without the significance of jaundice which is severe or persistent, or occurs in adults. Hemolytic jaundice may accompany various anemias and blood disorders.

Jaundice due to disease of the liver may be from various viral and other infections (such as infectious hepatitis or yellow fever), or from injury of the liver by various toxins or poisons such as carbon tetrachloride, chloroform, or phosphorus. In jaundice due to obstruction of extrahepatic bile passages, the occlusion may be due to gallstones, tumors, inflammations, or scars. Treatment of jaundice should be directed to determination of the cause and correction of the underlying disease.

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JAUNPUR, joun'pōor, city, India, in Uttar Pradesh State, capital of Jaunpur District. It is on the Gumti River, 35 miles northwest of Benares, and is noted as a perfume-making center. It is also a road and railway junction, and a trading center for grains, oilseeds, and sugarcane. In the 16th century it was the capital of a Muslim kingdom extending from Budann and Etawah to Bihar. Among its many fine architectural monuments are a mosque dating from 1376, the 15th century Atala Mosque, a 16th century gateway, and the 16th century bridge over the Gumti. Pop. (1951) 52,351.

JAUREGUI Y AGUILAR, hou'râ-gē ē ä-gē-lâr', Juan Martínez de, Spanish poet: b. Seville, Spain, baptized Nov. 24, 1583; d. Madrid, Jan. 11, 1641. He studied at Rome, Italy, and in 1610 was again in Spain with a reputation

as both painter and poet. He is supposed to have painted the portrait of Miguel de Cervantes Saavedra mentioned in the prologue to *Noveles Ejemplares*, which is believed to be the one now in the possession of the Real Academia Española; and his translation of Tasso's *Aminto* (Rome 1607) is praised in the second volume of *Don Quixote*. His *Rimas* (1618) comprised a collection of charming lyrics, and in its preface the poet severely scored the affectations of the school of Luis de Góngora y Argote.

JAURES, zhô-râs', **Jean Léon**, French socialist and politician: b. Castres, Sept. 3, 1859; d. Paris, July 31, 1914. He taught in Albi and Toulouse, and in 1885 entered politics and was elected to the Chamber of Deputies from Tarn; at this time he was a moderate Republican. In 1889 he failed of re-election, and returned to Toulouse, where he was active in the establishing of a college of medicine. Becoming a Socialist, Jaurès defended the strikers at Carmaux, and in 1893 was again elected to the Chamber, where he became one of the leaders of the Socialists. He failed of re-election in 1898, but was again elected in 1902. When the Socialist Alexandre Millerand accepted a position in the cabinet, Jaurès defended his action, thus opposing Jules Guesde and the *Parti Ouvrier*, but sought at the same time to reconcile the factions. He also took an important part in obtaining a revision of the Alfred Dreyfus case. He stood out as a champion of the workmen in the great strike of 1910. At a Socialist conference in Brussels in the summer of 1914 he made a strong attack on militarism, and declared himself in favor of an international strike for the prevention of war—an attitude which subjected him to severe criticism, and was directly the cause of his assassination by shooting at the hands of a half-demented man outside a café in Paris at outbreak of World War I. He was one of the greatest leaders of French Socialism, and probably the greatest orator in the Chamber of Deputies. He founded *L'Humanité* in 1904, and contributed six of the 12 volumes of the *Histoire Socialiste* (1904–1908).

JAVA, jā'vā, island of Indonesia, fifth largest and most important of the islands of the Malay Archipelago, is bounded on the north by the Java Sea, on the east by Bali Strait, on the south by the Indian Ocean, and on the west by Sunda (Soenda) Strait. Across the 16-mile-wide Sunda Strait lies the great island of Sumatra; and only one mile across Bali Strait, at its narrowest point, is the island of Bali. Madura (Madoera) Island is close to the northeast coast of Java and is considered almost a part of it. Java has a length, from east to west, of 600 miles, and at its widest part it has a width of 125 miles. The area is 48,830 square miles. With a population of 52,756,000 (1952), Java is the most densely populated of the islands of Indonesia.

Djakarta (Jakarta), the capital of the republic and known as Batavia under the former Dutch administration, lies on the northwest coast of Java at the mouth of the Tjiliwong (Tjiliwong) River; it has a population of 2,800,000 (1952). Tandjong Priok (Tandjoengpriok), the port of Djakarta, is six miles to the eastward. The second largest city and port in Indonesia is Surabaya (Surabaya), at the mouth of the Kali Mas River opposite Madura; the population

totals 800,000. Semarang (pop. 250,000) is a port on the north central coast; and Tjilatjap (30,000) is the only safe harbor on the island's south coast. Djokjakarta (Jogjakarta), a city (1,500,000) in central Java, is mainly a spiritual and cultural center; from 1946 to 1950 it was the capital of the republic. Other inland cities include Bandung (750,000), a holiday and tourist resort on the high plateau in the northwest; Surakarta (500,000), 35 miles northeast of Djokjakarta and likewise a center of Hindu-Javanese culture; Bogor (124,000), a scientific center 35 miles south of Djakarta; and Magelang (60,000), site of the immense 9th-century temple of Borobudur (q.v.).

Geology.—Java is formed mainly of tertiary, though partly of post-tertiary strata; but by volcanic action the arrangement has been much disturbed. Rocks containing fossil invertebrates are common, and the fossils of vertebrates have also been discovered. Lignite is found in various parts of the island, and coal is mined in Djokjakarta and Bantam. There are petroleum deposits near Rembang and Surabaya, and also on the island of Madura. Tin is mined, and other minerals include sulphur, asphalt, salt, and manganese. Limestone and marble are plentiful in the southern part of the island.

Topography.—The Indian Ocean, which beats with great force along the south coast, has prevented the formation, on that side, of such alluvial plains as extend along the north coast. From the same cause the south coast is generally unsafe for shipping, while the north affords excellent anchorage at almost all times and places. The south presents a continuous front of crags and rocks, forming the outer edge of an extremely mountainous country. The north is flat and low, and covered in many places with mangrove swamps. Mountains in the wide western section of Java lie, for the most part, close to the southern coast, the land sloping abruptly to the Indian Ocean and, on the north, descending gently across rich agricultural country to the Java Sea. In the center of the island, the mountains are situated roughly midway between the north and south coasts and virtually constitute a range. The mountains and lowlands are irregularly intermixed in the eastern section of the island.

The whole configuration of Java has been transformed by volcanic action. There are 20 or more mountain peaks with elevations exceeding 8,000 feet, and more than 100 volcanoes, of which 13 are still active. Semeroe (Semeru), 12,060 feet in height, is an active volcano and the highest mountain in Java; it is in the eastern part of the island, southeast of Malang, and joins with the Tengger Mountains, to the northward. Salak (7,254 feet), in western Java, had severe eruptions in 1669 and 1699 but is now extinct; Gede (9,705 feet), 45 miles southeast of Djakarta, has had many eruptions since 1832; Papandayan (8,744 feet), 12 miles southwest of Garut (Garoet), western Java, erupted violently in August 1772, destroying some 3,000 persons; Galunggung (7,221 feet), 10 miles east of Garut, had a destructive eruption in 1822; Tjikoeraj (9,255 feet) is the highest extinct volcano in the mountain groups around Garut; and Slamet (11,247 feet), in west central Java, is also inactive. The eruption of Krakatoa (q.v.), the volcanic island in Sunda Strait, in August 1883 was the most tremendous of modern times; it killed 36,000 people in western Java. The island is sub-



Above: In Garut, a health resort in the mountains of western Java, is this unusual mosque built by Javanese Muslims in Javanese architectural style.

JAVA

Right: These young women, typical of western Java, are wearing the beautiful batikd fabrics of their native land. Their garments are a sarong, wound tightly around the body, and a jacket above it.



(Above) K. Pelzer from Black Star; (right) Ava Hamilton; (below) Philip Gendreau, N.Y.

Below: Surabaya, one of the chief ports in the Far East, lies at the eastern end of Java just above the mouth of the Kali Mas River, and is as picturesque as this scene would suggest.





Above: A business street in Djokjakarta in south central Java. Left: An Indonesian worker is making stamped batik. Below: A river village inside Djakarta's limits. Adequate housing for the city's large population is a major problem.

(Above) Press Association, Inc.; (left) by Deane Dickason from Ewing Galloway; (below) United Press Photo



ject to earthquakes, though as a rule they are not severe. Three earthquakes are known to have preceded and 19 accompanied volcanic eruptions. A most destructive earthquake occurred in 1867.

Rivers flowing into the Indian Ocean, to the south, are short and rapid; while those flowing northward, into the Java Sea, are longer and more suitable for navigation. The longest river is the Solo (335 miles in length), which empties into the Java Sea opposite the west end of the island of Madura; in its lower course it is known as the Bengawan. The Brantas (195 miles) also known as Kediri, flows into Madura Strait in two branches, on one of which (named Kali Mas) stands Surabaya; it is navigable as far as Kediri. The capital city of Djakarta stands at the mouth of the Tjiliwung (50 miles), which rises on the northern slopes of Mount Pange-rango.

Climate.—During the day the temperature of the plains and valleys ranges from 85°F. to 94°; and during the night from 73° to 80°. The mean temperature at Djakarta is 78.69°F. At an elevation of 6,000 feet the thermometer descends to 60°, while the tops of the highest peaks are often covered with ice, but no snow falls. The breezes from the sea modify the temperature. There are two seasons: the dry from April to October, and the rainy season from November to March. During the rainy season there is an almost continuous rainfall except for a short time in the morning. The annual rainfall is about 80 inches. The island is not subject to storms which injure life or property, but near the high mountains there are frequent thunderstorms.

Fauna.—Including domestic and marine animals, at least 100 kinds of mammalia inhabit Java. In the western area the one-horned rhinoceros is not uncommon; and in the higher elevations the royal tiger, panther, and wild cat keep the inhabitants in constant alarm by their depredations. Wild pigs of two different species are most destructive of crops. There are only two species of the ape kind, but they people the forest in countless numbers. Two kinds of lemurs inspire the inhabitants with superstitious fear by their mysterious nocturnal habits; and this island may be esteemed the native seat of the largest bats, some of which measure five feet across the wings. They may be seen suspended from the branches in hundreds during the day, and at night they devastate the orchards and gardens. Two civets are common and supply a perfume of which the Javanese are passionately fond; the wild ox abounds in the woods; and the buffalo is the only animal used in agricultural labor. The horses are small, but vigorous, and, as in India, are not used for agricultural purposes. Two species of wild dogs and six species of deer are found here. Among the domestic animals are the buffalo, ox, horse, goat, and sheep. The ornithology of Java is rich and varied, both in genera and in species. About 300 species of land birds have been found on the island, among them the peacock, partridge, quail, 10 different species of pigeon, 11 species of heron, two of cuckoo, the woodpeckers, the black and crimson oriole, the hornbill, eagle, owl, the brilliant looking and appropriately named minaret flycatcher, and the "swift" (q.v.); and the mino bird, so apt in learning to mimic human speech, is common. Almost all the known generic groups of rapacious birds are found here in great num-

bers, and gallinaceous fowls are plentiful. A variety of reptiles are found on the island, among them the python. Insects cover the grounds and plants in countless numbers; but few are distinguished for brilliancy or variety of color, or are remarkable in form. Fish are plentiful in the rivers and along the coast; but those of the rivers are of inferior quality for food. Excellent oysters are abundant on the north coast, and prawns, from which a condiment called trasi is prepared, are considered delicious by the natives. Crocodiles from 20 to 30 feet in length inhabit the watercourses.

Flora.—With a temperature ranging from 94°F. to the freezing-point, a volcanic soil plenteously watered naturally and artificially, it is not surprising that Java should be of astonishing fertility; the range of its vegetation naturally follows that of its temperature, from the palms of the tropics to the mosses of the temperate zone. Mangrove swamps fringe most of the coast line, and a short distance inland occur the coconut, nipa, and other palms. Low hills are covered with alang-alang grass, 3 to 4 feet high, wild sugar cane, acacia, and bamboo—the last frequently of immense size. Most of the cultivated crops, particularly rice and sugar, grow at elevations below 2,000 feet. The vast forests cover a very extensive surface. In the rain forests are magnolias, a great variety of vines, rattans, and at least 80 species of fig trees, which are remarkable for their great height and vigorous growth. The dense forests of central Java contain the valuable teak tree (which sheds its leaves in June and buds again in October), mahogany, camphor, and many other forms of vegetation. These are followed still higher up by the plane-like liquidambar, with their erect stems covered with parasites, and *Rubiaceae*, the latter of numerous species; some of them exhaling a very fetid odor. Along the upper limits of the liquidambar, about 4,000 feet above sea level, lofty trees are still plentiful. Here may be seen *Podocarpus cupressus*, with its lofty straight stem, a tree allied to the yew and furnishing the best timber in Java. There are also the dammar pine, rhododendrons, laurels of numerous species, chestnuts, oaks, magnolias, myrtles, and other vegetation common to the temperate zones. About an elevation of 7,000 feet the vegetation changes its aspect. Mosses appear, and these, with heaths, are the principal plants found on the loftier peaks.

The People.—Although Java comprises only seven per cent of the land area of Indonesia, it supports two thirds of the archipelago's people, and is one of the most densely populated islands of the world. The three main ethnic groups are people of the Deutero-Malay race. The whole of central Java is occupied by the Javanese, who comprise about three quarters of the population; they are also found on the north coast to the westward and on the south coast eastward. The Sundanese, who form about 15 per cent of the population, live at the western end of the island at the higher elevations; and the Madurese, about 10 per cent of the population, are found in eastern Java as well as on the neighboring island of Madura. All three races are shorter than Mongolians and Caucasians. The shortest and the most sturdy are the Sundanese, and their eyes are more slanted than those of the Javanese and Madurese. In general, it may be said that all three races are light brown in color, and the hair of the head is black, thick, lank, and harsh; a

few, short straggling hairs compose the beard, and on other parts of the body hair is either scanty or altogether wanting. The people are patient and enduring, but they are most susceptible to affronts, which they are not slow to avenge with the kris—a dagger having a serpentine blade. All the people, without distinction, are passionately fond of gaming, more especially of cockfighting. Most of the people, being agriculturists, live in small villages. Their houses are light structures of bamboo, built upon the ground except in the case of the Sundanese, who raise them on piles several feet above the ground. Leaves of the nipa palm or alang-alang grass are used for thatching the roofs of the houses, and bamboo, split and flattened, provides the walling; the floors are of pounded earth.

Religion.—The advent of Indians in the 11th century brought Buddhism to Java. This was largely displaced in the 15th century, however, when Arab conquerors arrived and influenced Javanese life with Moslem culture. Islam was eventually embraced by 90 per cent of the people of Java. There still remain some primitive Animists, and Christianity has some 2,000,000 adherents. The polygamy permitted by Islam continues to be practiced by wealthier Javanese, but most of the people are monogamous.

Language.—It is not certain whether the name of Java be connected with the Sanskrit Javanna and Yavana, both of which, besides being related to Ἰωνία as names of Greece, also signify (especially the latter) Bactria, Arabia, and other foreign countries, and, moreover, swift, horse, etc.; or whether its etymon be of a different origin. The Javanese is the most cultivated of all Polynesian languages, owing to the very early intercourse of the island with the continent of India, whose Aryan as well as Dravidian influence is attested by the presence of Malabaric words along with those from the Sanskrit, not only in Javanese, but also in the idioms of Sumatra, Madagascar, and other islands. Both religious and political revolutions have served to modify the condition of the languages.

There are four dialects on the three islands which form the linguistic group in question, namely: (1) the tongue of the mountaineers of Sunda, in the western part of Java, east of Tagal, probably vernacular through this whole region before the introduction of Islam, now spoken by about one tenth of the population of the island; it contains many Malay and some Sanskrit words, stands in the same relation to the principal language as the Welsh does to the English, and is best spoken at Bantam, sluggishly at Bogor and Chianjore and verging to the Javanese at Cheribon. (2) The Javanese proper, east of the last-named city, extending through the rest of the island, especially along its north shore; its words are long at Tagal, shorter at Samarang, full, short and strong at the courts of Surakarta in the center and Djokjakarta in the south; it approaches the Madurese at Surabaya and the Balian at Banyuwangi. (3) The dialect of Madura and Sumanap, which has many Sunda words, with more of Malay, and with peculiar endings. (4) That of Bali, little different from the general Javanese. This island preserves the ancient letters as well as Brahminism, both expelled from Java in the 15th century. A sort of jargon, analogous to the *lingua franca*, is spoken at Djakarta, being a medley of Dutch, Portuguese, Javanese, and Malay.

Along with the preceding there are also peculiar styles or idioms of speech, varying in accordance with social position and age, as the *madhjo* (intermediate), between equals; the *bása* or *bohoso-ngoko* (language popular), to inferiors; the *bása-kramo* (language superior), urbane, court idiom, about three fourths of it Sanskrit, used by poets as the speech of gods, heroes, and ghosts. As to locality, there are also two vernacular idioms, namely, the *bása-dalam* of the interior and the *bása-luar*, spoken along the shores. The Kavi (learned, wise, poet) is the ancient sacred language of Java and consists of about six parts of Sanskrit, less altered than in the Pali, to four of Javano-Malay. It owes its origin to Brahminic immigration, about the beginning of our era. It is to the Javanese what Sanskrit is to the Hindostani, and Pali to the Indo-Chinese languages. Declining in the 14th century, it took refuge in Bali and was imperfectly known by the Panambahan at Sumanap at the time when Sir Stamford Raffles (q.v.) was in Java. Passages in the Kavi are sometimes quoted on peculiar occasions, as for instance in fables and dramas; the term itself is employed as a title of works, etc., such as *Sekar-kavi*, flowers of poetry, whence *Sekarini*, a Kavi meter; *Ramakavi*, the Javanese Ramayana; *Kavindhra*, principal singer or poet (named *ma-kathā*, narrator, in Tagala). A few specimens of words may show the relation of the Javanese to the common Malay, where the difference, if not specially noted, is sometimes more in the accent than otherwise: *langit*, heaven; *tanah*, earth (Mal. also *benua*, region); *ayer* (Jav. also *banyu*), water; *laut* (Jav. *lahut*), sea; *dhina* (Mal. *hāri*), day; *bengi* (Mal. *mālam*), night; *vulan* (Mal. *bulan*), moon; *terang* (Mal. *trang*), light; *mati*, to die; *lulat* (Mal. *kāsih*), to love; *dara*, virgin; *dhēva* (Mal. *tuhan*), god, lord; *mangan* (Mal. *mākan*, *santap*), to eat; *bāpa*, pak (Mal. *pā*, politely *ayah*), father; *ma*, *bok* (Mal. *mā*, *amā*, politely *ibu*, *bonda*), mother, etc. Compounds and derivatives abound, but the latter are more frequently formed by suffixes than by prefixes, in which the Tagala is very rich. There are many contractions into *tr*, *ngr*, *ngr*, with the dropping of short vowels, together with the alteration of the initial sound (similar to the Celtic), and other variations which obscure the etymic origin, thus: Sans. *nātha*, master, lord, becomes *tata*, order, to reign; Jav. *neda*, to eat, *teda*, food; *nulis*, to write, *tulis*, scripture; *nitik*, to prove, *titik*, proof. The prefix *n* denotes verbs, *t* substantives; other changes are: *nyatur*, to tell, *chatur*, tale; *nyerrat*, to write, *serrat*, writing, etc. The doubling of the first syllable makes verbs, as *tutulung*, to help, from *tulung*, aid; *gagriya*, to dwell, from *griya*, house. The insertion of *in* is the sign of the passive voice. Substantives are also made by prefixing *pem* (*pen*, *pe*), denoting an agent; thus: *pem-pekto*, carrier, from *pekto*, to carry; *pen-dahar*, eater, etc.; by prefixing *ka*, a sign of the past participle; *kabekto*, Lat. *allatum*; by suffixing *n* (*en*, *an*): *bakt-en*, the carrying, *dahar-an*, Lat. *cibus*; and by both prefix and suffix: *ka-da-har-an*, an eatable. Articles, gender, and the dual number are wanting. In the plural, cases are denoted by particles, and also by reduplication, as in Japanese. The genitive relation is shown by the precedence of the noun or by inserting *ing*. The other relations of case are indicated by means of verbs. The adjective is unchanged after the



Above: Natives bringing tangerines from nearby plantations to local markets.

JAVA

Right: Oxen are yoked to provide transport for this charming cart and its owner's wares. The yoke's painted pole will keep off evil spirits.

(Above) Dée Bredin from Black Star; (right) Ewing Galloway; (below) Information Office of the Republic of Indonesia.

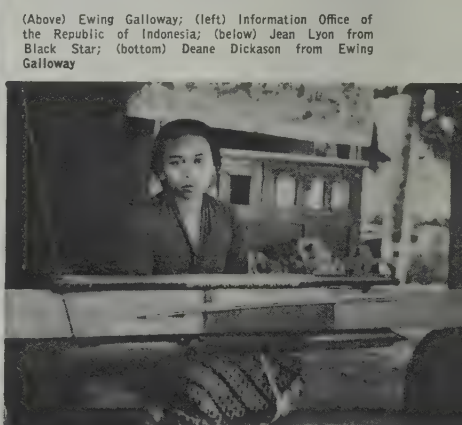


Below: Workmen apply the finishing touches to automobile tires in a plant at Bogor, 30 miles south of Djakarta.





Above: The 8th or 9th century Buddhist temple of Borobudur, in central Java, probably the most elaborately carved building in the world. Left: Students in the library of a technical college in Bandung. Below: A Javanese woman works at her loom. Bottom: A modern hotel in the resort city of Bandung, in western Java.



(Above) Ewing Galloway; (left) Information Office of the Republic of Indonesia; (below) Jean Lyon from Black Star; (bottom) Deane Dickason from Ewing Galloway



substantive. Pronominal forms are fewer than in Malay: *kita*, we in Malay, means I in Javanese.

Literature.—The literature, which is in Kavi, dates from about the commencement of our era, and is rich, especially in legends concerning cosmogony. The subjects of the works are mostly either of a mythical or ethical character. Prominent among the former are the *Kānda* (Sans. *Khandata*, fragment, section), *Pepakem* (book), or *Sejarah* (history); *Manek-Maya*, a mythical genesis, in which Buddhism predominates; *Vivaha-Kavi* (matrimonial poem), about a *Rasaksa* (evil spirit) who courts a *Vidaduri* (nymph); *Rama-Kavi*, the Javanese *Ramayana*; *Parikespit*, "Arjuna's Grandson"; *Mintaraga*, a poem on Arjuna in the Indra mountain. This kind of composition comes down to the time of Aji Saja Baya. Of the ethical order are the *Niti Sastra Kavi*, in the purest style, of about the 13th century; and *Śrūti*, which already alludes to Islam. But the *Brata Yudha* ("Holly War") is an epos mostly on the deeds of Arjuna; being an episode of the Mahabharata, in 712 stanzas, with varying rhymes. The *Sastra Menawa* is a Javanese imitation of the ordinances of the Indian Menu. Indeed, most of the Kavi works are such imitations. Whether mere versions of Sanskrit works have been made or still exist is not precisely known; but there are many Javanese versions from the Kavi. Javanese literature abounds in romantic compositions, mostly of elegiac form. Among these, the adventures of the popular hero Pandji are most prominent. Dramas, and especially puppet shows, called *wayang* (shadows), and with figures of either leather or wood personating heroes, are popular.

Production.—The vast majority of the people of Java are engaged in agriculture, despite the fact that the great cities are of major industrial and commercial importance. There is a small class of fishermen on the sea coasts and an increasing number of urban residents are skilled artisans, but most Javanese live directly or indirectly by the cultivation of the land. Rubber, sugar, coffee, tea, and cocoa, the principal economic crops, have long been cultivated on immense foreign-owned plantations, and since establishment of the republic following World War II an increasing number of these products have been grown by small farmers. The island also produces some 90 per cent of the cinchona bark from which quinine, the specific for malaria, is manufactured; and other products which are exported include copra (the dried meat of the coconut), palm oil, kapok (a silky fiber used to fill mattresses), and sisal hemp. Rice, the staple foodstuff in Java, is produced on a great scale; with the aid of irrigation two crops can be raised each year. Sugarcane and tobacco are also cultivated, and other crops include corn, cassava, peanuts, soya beans, and capsicum.

The forests yield teak and other valuable woods, many of them exported, while coal is mined and petroleum is produced in several parts of the island. The Javanese practice about 30 crafts, some of them of considerable antiquity and of high artistic standard. They excel all others in the archipelago in the working of metals, being especially skillful in the manufacture of the kris—the dagger customarily worn by every man and boy above 14 years of age; the kris is also worn by many ladies of high rank. Excellent gongs and other musical instruments of brass are also made; there is a ready market for them in

neighboring countries. Silverwork is also a highly developed craft. The only textile material woven by the Javanese is cotton, of which they make only a stout durable calico; this is purely a domestic manufacture, carried on exclusively by the women. Women also weave a coarse cloth from raw silk imported from China. The Javanese are widely known for the process of dyeing cloth known as *batik*, in which wax is applied to those parts of the cloth not to be dyed; the threads are dyed before weaving in a more complicated textile process known as *ikat*. Textiles of both *batik* and *ikat*, of great artistic merit, are worn by men and women alike. Paper of the nature of the ancient papyrus is a manufacture peculiar to the Javanese.

History.—Between the 1st century A.D. and 700 A.D. Java was overrun by Hindu princes from India, who introduced Buddhism. Javanese history at this period is written in the still existing magnificent remains of temples and other public buildings, which are plentifully scattered over the island. Near Prambanan (Brambanan) are the ruins of many Hindu temples, one of them dating from the 9th century, which are eloquent of the magnificence of the period in Java. At Borobudur (q.v.), near Magelang, is probably the largest Buddhist temple in the world; perched on the summit of a hill, above which it towers to a height of 120 feet, it is adorned with 998 bas-reliefs illustrating the life of Buddha. These and similar remains attest that the worship of Brahma and Buddha once prevailed in the island. Between 1335 and 1380 the state of Majapahit, in eastern Java, conquered the Sriwidjaja empire of Sumatra (which had had its beginnings in the 7th century) and extended its influence to include almost the whole of the Malay Archipelago. In turn, the Moslems had seized most of the colonies of Majapahit by about 1478, after a period of internecine strife, and by 1518 Majapahit itself had been totally destroyed. Bantam and Mataram were the most powerful Moslem states in 1511, when the Portuguese, the first of a succession of European traders, arrived. The Portuguese were followed in 1595 by the Dutch, who soon eclipsed them. In 1619 the Dutch established their capital on Java at Batavia, a town built on the site of Djakarta (Jakarta), chief port for the Sundanese kingdom of Padjadjaran, and from that point gradually extended their influence through most of the island. Java was occupied by the British from 1811 until 1816. In 1825 the Dutch authorities were confronted with a large-scale revolt which was not put down until 1830. The Dutch decreed abolition of slavery in Java on Sept. 20, 1859. The Javanese had never had slaves, and there were but a few thousand on the island. During World War II Java, together with all the Malay Archipelago, was occupied by Japanese forces. With Japan's surrender the Dutch attempted to reestablish their authority in Java, but were compelled to acquiesce in creating the independent Republic of Indonesia. Batavia, resuming its ancient name of Djakarta, became the capital of the republic in 1950. See also INDONESIA, REPUBLIC OF.

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WHEELER B. PRESTON.

JAVA, The. See CONSTITUTION OR OLD IRONSIDES.

JAVA FOWL. See POULTRY.

JAVA SEA, part of the Pacific Ocean between Borneo and Java and east of Sumatra. It is about 200 miles wide, 600 miles long, and shallow, with a maximum depth of about 300 feet. In February–March 1942, during World War II, it was the area of the Java Sea Battle, in which the Japanese defeated Allied naval forces.

JAVA SEA, Battle of the. See WORLD WAR II—9. *War in the Southern and South-western Pacific.*

JAVARI, zhà-và-ré', or **YACARANA,** yà-kà-rá'ná, river, South America, rising on the Peru-Brazilian border, about latitude 7° S. It flows north and northeast into the Amazon River and is navigable for about half of its length. The greater part of its course of about 650 miles forms the boundary between Brazil and Peru.

JAVELIN, jāv'lin; jāv'ě-lin, a short, light spear thrown by hand. In ancient warfare it was used by both horse and foot soldiers. The *pilum* of the Romans was a weapon of this description and could be thrown or thrust. The shaft was four and one-half feet long and the barbed iron head was of equal length, but, as it extended halfway up the shaft, the whole length of the weapon was about seven feet.

In ancient and medieval times hunters of large game often used javelins. The small spears of many savage tribes are called javelins. Throwing the javelin has been one of the contests in the Olympic games (q.v.) since 1908.

JAY, jā, **SIR James,** American physician: b. New York, N.Y., Oct. 27, 1732; d. Springfield, N.J., Oct. 12 or 20, 1815. He was an older brother of the statesman and jurist John Jay (q.v.). He received his medical degree from the University of Edinburgh in 1753 and began practice in New York City, but became dissatisfied and went to London, where in 1762 he agreed to collect funds for King's College (now Columbia University). When Jay found that the Reverend William Smith was there on a similar mission for what is now the University of Pennsylvania, they cooperated and raised about £10,000 for each institution. King George III knighted Jay in 1763.

After the outbreak of the Revolution, Jay, apparently sympathizing with the American cause, invented an ink which he used in communicating to the colonies military information obtained in England. He returned to the United States in 1778, was a member of the New York Senate from 1778 to 1782, and there aided John Morin in the passage of the Act of Attainder (1779), by which the property of prominent New York Loyalists were confiscated. In April 1782 he was captured by the British, but was released by Sir Guy Carleton and was allowed to go to England. Thereafter even his brother John doubted his patriotism. After practicing medicine for a time in England and on the Continent, he returned to the United States.

Jay was a trustee of the College of Physicians and Surgeons (New York), 1807–1811, and his

name appeared in the charter of the college in 1791.

JAY, John, American statesman: b. New York, N.Y., Dec. 12, 1745; d. Bedford, N.Y., May 17, 1829. Patriot, statesman, legislator, jurist, diplomat, descended from old Huguenot and patrician Dutch settlers of New York, Jay graduated from King's College (now Columbia University) in 1764, studied law, and was admitted to the bar in 1768. He married, April 28, 1774, Sara Van Brugh Livingston, youngest daughter of William Livingston (q.v.), the revolutionary governor of New Jersey.

Jay's first responsibility in his career of public employment was as secretary of the Royal Mixed Commission appointed in 1773 to settle the disputed boundary between New Jersey and New York. The success of this commission may have been the precedent in Jay's experience for the mixed commissions later created in the famous treaty of 1794 with England, arbitral commissions which in turn afforded a precedent for later United States treaties.

The public disputations preceding the American Revolution soon put an end to Jay's law practice and diverted him into public service. As a member of the New York Committee on Correspondence and of the Continental Congress, he opposed independence as inviting mob rule and chaos. He was absent from the Continental Congress on the day when the vote for independence occurred, but, once the fateful step was taken, he adhered patriotically and unwaveringly to it. As chairman of a committee in the New York Provincial Congress, he immediately drafted the resolutions confirming independence (July 9, 1776). He also had a leading part in the state convention that drafted the constitution of New York and served for a few months as first chief justice of his state. He was elected president of the Continental Congress, Dec. 10, 1778. Congress sent him, as its ranking member, to Spain in 1779 as a minister plenipotentiary, seeking recognition of the United States, financial succor, and military alliance in the war against Great Britain. But Spain refused to recognize the independence of the United States, although she entered the war as an ally of France. Jay and his wife lingered in Spain until the spring of 1782, when he joined Benjamin Franklin in Paris as a member of the United States commission for the negotiation of peace with Great Britain.

In these negotiations Jay played an important part, if not the leading role. He insisted that the British commissioner be empowered to treat with plenipotentiaries of the United States of America instead of with those of individual "Colonies." Suspicious of secret French missions to London, he privately urged the British government to come to a quick peace with the United States which might thereby cut the ties that bound the new nation to France. He influenced his fellow commissioners to sign separate, but *conditional*, preliminary articles of peace with Great Britain without prior approval by the French government, thereby violating their instructions but not the Franco-American alliance and its pledge against any separate peace.

After signature of the final peace treaties, Jay declined the post of minister to Great Britain or to France and chose to go home, yearning for the comforts and the pleasures of private life. But Congress had already appointed him as its

secretary of foreign affairs, and the experienced Jay accepted the burden of that office. His most important negotiations as secretary of foreign affairs (1784-1789) were with Great Britain and Spain, concerning commerce and frontier disputes, including Western Indian tribes and (in the case of Spain) navigation of the Mississippi River; but neither came to any conclusion, if only because of the weakness of the government under the old Articles of Confederation. Upon the organization of the new national government under the new and still-continuing Constitution, President George Washington appointed Jay as first chief justice of the United States. The most important case which Jay decided during his tenure as chief justice (1789-1795) was *Chisholm vs. Georgia*, which affirmed the right of a citizen of one state to sue another sovereign state in the Union. This decision led to the quick adoption of the 11th Amendment to the Constitution, which had the effect of strengthening states rights by reversing in principle Jay's decision.

During the war crisis of 1794 with Great Britain, President Washington, upon the advice of Alexander Hamilton and other Federalist leaders, sent the chief justice to England as envoy extraordinary and minister plenipotentiary on a special mission to reach a peaceful settlement. After several months of negotiation with Baron Grenville (William Wyndham Grenville, 1759-1834), he signed, on Nov. 19, 1794, the celebrated treaty which bears his name in United States history (see JAY'S TREATY). Jay's treaty might just as well be called Hamilton's Treaty, because the private letters of Hamilton to Jay were more influential than his official instructions penned by Edmund Randolph, the secretary of state. It was the price which the Federalists paid for a continuation of United States neutrality in the war between France and Great Britain and for support of the new nation's financial credit, under Hamilton's fiscal system.

Upon his return to New York in 1795, Jay resigned as chief justice in order to serve as governor of New York, to which office he had been elected during his absence and which he occupied until 1801. His integrity as governor is reflected by his rejection of Hamilton's proposal, after the Republican victories in the state and national politics in 1800, that Jay call a special session of the expired Federalist legislature to choose Federalist electors for the presidency before the newly elected legislature should meet to designate Republican electors who would vote for the Republican candidate, Thomas Jefferson. The closely contested presidential election, Hamilton pointed out, would depend upon the votes of New York. Jay rejected this political trickery, and wrote on Hamilton's letter urging the stratagem: "Proposing a measure for party purposes which I think it would not become me to adopt."

Following the Republican triumph, Jay spent the rest of his life, 28 years, in complete retirement, saddened by the death of his wife on May 28, 1802. At his death he left one daughter, who died without issue, and two sons. Both sons, Peter Augustus Jay and William Jay (q.v.), had distinguished political and civic careers, as they carried the Jay family into continuing generations.

Bibliography.—Bemis, Samuel Flagg, *Jay's Treaty; a Study in Commerce and Diplomacy* (New York 1923); id., *Diplomacy of the American Revolution* (New York 1935); Monaghan, Frank, *John Jay, Defender of Liberty* ... (New York 1935); Bemis, Samuel Flagg, *Pinckney's*

Treaty; a Study of America's Advantage from Europe's Distress, rev. ed. (Baltimore 1941).

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JAY, John, American lawyer and diplomat: b. New York, N.Y., June 23, 1817; d. there, May 5, 1894. He was the son of William Jay, American jurist, and grandson of the statesman John Jay (q.v.). After graduating from Columbia College in 1836, he studied law in New York City, and was admitted to the bar in 1839. He became a prominent opponent of slavery and was counsel for several fugitive slaves; and at a meeting held at the Broadway Tabernacle in New York City in 1854, he drafted resolutions, which were adopted, opposing repeal of the Missouri Compromise. At Syracuse, N.Y., in September 1855, he took a leading part in organizing the New York State Republican Party. From 1869 until his resignation in 1874 he was United States minister to Austria; in 1877 was appointed chairman of the so-called Jay Commission for the investigation of the New York customhouse administration; and during 1884-1887 was the Republican member of the New York State Civil Service Commission and helped to frame the state's first civil service law. He was a founder of the American Geographical and Statistical Society (1852); and of the Union League Club (1865), twice serving as its president (1866, 1877); was a charter member of the Huguenot Society of America and its first president (1883-1894); and long was corresponding secretary of the New York Historical Society. In 1890 he became president of the American Historical Association.

JAY, William, American jurist: b. New York, N.Y., June 16, 1789; d. Bedford, N.Y., Oct. 14, 1858. He was the son of the statesman John Jay (q.v.) and, after graduating from Yale College in 1807, studied law with John B. Henry at Albany, but because of defective eyesight was obliged to withdraw from the profession. He began to farm the family estate at Bedford and became interested in various philanthropic movements, including the antislavery cause. A founder of the American Bible Society (1816), he long defended it against attacks by the Right Reverend John Henry Hobart, Episcopal bishop of New York. From 1818 to 1843, with one short interruption, he was judge of the court of Westchester County. From 1835 to 1837 he served as corresponding foreign secretary of the American Anti-Slavery Society. He wrote much on antislavery and was recognized as a leader of the more conservative of the abolitionists. Among his publications were *The Life of John Jay* (2 vols., 1833); *An Inquiry into the Character and Tendency of the American Colonization, and American Anti-Slavery Societies* (1835); *War and Peace: The Evils of the First and a Plan for Preserving the Last* (1842, reprinted 1919); *Miscellaneous Writings on Slavery* (1853).

His brother, PETER AUGUSTUS JAY (1776-1843), was also a lawyer and was recorder of New York City during 1820-1821.

JAY, town, Maine, in Franklin County, on the Androscoggin River, 28 miles north of Lewiston, on the Maine Central Railroad. Granite quarries, paper and pulp mills, and a shoe factory

are within the town limits. Pop. 3,247.

JAYADEVA, jū'yā-dā'vā, the last great writer of Sanskrit: fl. 1200. The details of his life are unknown; but his *Gītāgōvinda* (*Song of the Divine Cowherd*) is a fine religious drama written in lyric verse, divided into 12 short cantos or scenes, with provision for musical accompaniment and dancing. It is best considered as a mystery play, the union of the soul with God being adumbrated in the loves of the god Krishna (q.v.), here represented as a cowherd, and Rādhā, a milkmaid. Krishna's immense and apparently willful infidelity to Rādhā and his later return to her may be taken as symbolical of the imponderable ways of God to man. The climax of the mystery comes when the finite mind (Rādhā) ceases to question the infinite soul (Krishna), submitting itself nakedly and without reserve to the divine will. Fortunately God thirsts for his devotee as much as she for Him. In Indian fashion, this love lore is conveyed in language which evokes a golden mirage of sensual passion, but Jayadeva's audacious eroticism may be compared with that of *The Song of Solomon* or of the pairs of sculptured lovers who glorify many ancient Indian temples. The final effect of such art is delicate rather than gross, a mood of intense spiritual exaltation. The sex feeling that dominates the physical creation is seen to be the chief nourisher of the soul itself.

The *Gītāgōvinda* has found three good English translators: Sir William Jones, "Gitagōvinda: or, The Songs of Jayadēva," *The Works of Sir William Jones*, vol. 1 (London 1799); Sir Edwin Arnold, tr., *The Indian Song of Songs*, . . . (London 1875); and Puran Singh, "The Gita Gobind: When Love is Prayer," in *The Spirit of Oriental Poetry* (London and New York 1926).

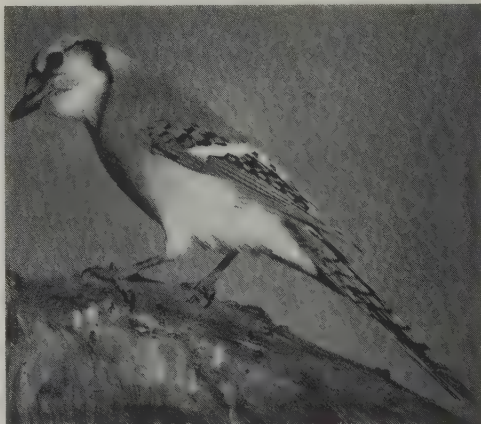
RODERICK MARSHALL.

JAYHAWKER, jā'hōk-ēr. Though the origin of the term has not been established, it appears to have been known in the Middle West and California as early as 1849, as a homespun term for a freebooter. During the Kansas-Missouri border warfare (1857-1859) over the slavery question, bands of Free State men were called jayhawkers. The term was also applied later to Union guerrilla bands in the Civil War. United States Senator James Henry Lane of Kansas declared in 1861 that "the people of Kansas are neither thieves, plunderers, nor jayhawkers." The term has lost its opprobrium with the passage of time, for Kansas has adopted the nickname Jayhawker State and Jayhawker is the popular nickname for a citizen of Kansas.

JAYNE, jān, **Horace Fort**, American biologist: b. Philadelphia, Pa., March 17, 1859; d. Wallingford, Pa., July 8, 1913. He was the son of a physician who became a wealthy drug manufacturer, and he himself studied medicine at the University of Pennsylvania, where he took his medical degree in 1882. Between 1882 and 1884 he also studied at the universities of Leipzig, Jena, and Johns Hopkins. He became professor of vertebrate morphology at the University of Pennsylvania in 1884 also serving as dean of the college faculty (1889-1894) and of the faculty of philosophy (1890-1894). He helped to found the school of biology, contributing liberally to its building fund, and for more than 10 years from 1894 directed the university's research institution,

The Wistar Institute of Anatomy and Biology, wherein he also was professor of zoology (1896-1904). He was the author of *Anatomy—A Preparation for Human and Comparative Anatomy* (1898) and of important scientific papers.

JAYS, jāz, a group of passerine, or song birds, closely related to magpies and crows and forming with them the family Corvidae. The family is a large one with about 100 species, of which about 40 are jays. The jays inhabit the



(Top) Allan D. Cruickshank from National Audubon Society; (bottom) Charles J. Ott from National Audubon Society

Above: Blue jay. Below: Canada jay.

boreal, temperate, and tropical regions of the New and the Old Worlds, with the exceptions of Australia and tropical Africa, but are more numerous in the New World with about 32 species. They are strictly arboreal, inhabiting coniferous, deciduous, or mixed forests as well as the chaparral or other scrub in the American Southwest and in Mexico. They are of medium size and usually colorful, various shades of blue predominating in their plumage, though some are gray, brown, green, or reddish. The jay is noted for its great boldness and noisy habits, but it can be furtive and quiet when occasion demands; and not all the species are bold, some being quite shy or very confiding in man. Their food is chiefly vegetarian, consisting of large seeds, such as acorns, of which they are very fond, or other seeds, such as

beechnuts, corn, and small nuts. In summer they become insectivorous and are not above robbing the nests of small birds for eggs or nestlings if they are left unguarded.

Among the better known jays are the common jay (*Garrulus glandarius*) of the Old World, a widespread and beautiful large species with a rich vinaceous coloration. In North America the best known is undoubtedly the blue jay (*Cyanocitta cristata*), a handsome, bold ruffian with bright blue wings and tail and a jaunty crest. The blue jay ranges westward to the Rocky Mountains and is replaced in those mountains and to the west by other crested, but darker, species such as Steller's jay (*C. stelleri*). Two other notable American jays are the scrub jay (*Aphelocoma coerulescens*) and the Canada jay (*Perisoreus canadensis*). The first is found in Florida and again in the West and is blue and lavender, but without a crest. The Canada jay, often called the camp robber, is gray and white and looks exactly like a huge chickadee. It inhabits only the coniferous forests of the north and is very tame and a pleasant companion much attracted to man.

CHARLES VAURIE.

JAY'S TREATY. Jay's Treaty of 1794 with Great Britain, by adjusting grave and perilous problems with England (frontier posts and boundaries, Indian relations, prewar debts to British creditors, treatment of returning British Loyalists, regulation of commerce) remaining from the treaty of peace and independence of 1783, preserved Anglo-American amity while the new federal government of President George Washington was becoming firm in a successful experiment of nationhood, and it confirmed the neutrality of the United States in the wars of the French Revolution.

Matters came to a war crisis in 1794, during the European War, after seizures of American neutral ships bound for French belligerent ports, according to dictates of arbitrary British naval orders in council; at the same time, the governor general of Canada made a hostile speech to a delegation of western Indians from United States territory to the effect that they and the king's warriors would soon be fighting side by side against the United States.

At the behest of Alexander Hamilton and other Federalist leaders, President Washington sent Chief Justice John Jay (q.v.) to London, where he negotiated and then signed, on Nov. 19, 1794, the celebrated treaty bearing his name. In turn for a promise to evacuate the northern posts by June 1, 1796, Great Britain secured acquiescence by the United States in the substance, but not the principle, of her naval measures for the duration of the war and agreed to arbitrate United States claims for naval spoiliations under color of British orders in council. The United States on its part agreed to the arbitration of claims of British prewar debtors and payment of awards by the United States government. At the same time provision was made for mixed commissions to settle disputed stretches of the uncertain Canadian-American boundary line in the north. (These commissions had no success, except for establishing the identity of the boundary river, the St. Croix, on the northeastern frontier.) The two parties also asserted the right of their citizens and subjects to the free navigation of the Mississippi River from its source to the sea (without mention of Spain!). Finally, the

treaty regulated commerce between the British Isles and the United States without discrimination between British subjects and United States citizens.

John Jay conducted these negotiations nominally under instructions from Secretary of State Edmund Randolph, but actually under private injunctions from Secretary of the Treasury Alexander Hamilton; the treaty was really more Hamilton's treaty than it was Jay's treaty. After heated discussion throughout the United States, the Senate, by a bare two-thirds majority of senators present, advised and consented to the treaty, and the president, after some hesitation, signed it, and ratifications were exchanged. The House of Representatives voted the necessary appropriations by a majority of only three votes.

There is little doubt but that Jay's Treaty saved the peace between Great Britain and the United States at a juncture vital to the life of the new nation and enabled it to grow in strength, while the European antagonists fell against each other in a mighty non-American war.

Consult Bemis, Samuel Flagg, *Jay's Treaty; a Study in Commerce and Diplomacy* (New York 1923); Burt, Alfred L., *The United States, Great Britain and North America, from the Revolution to the Establishment of Peace after the War of 1812* (New Haven 1940).

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JAZZ, *jāz*, an omnibus term for various 20th century styles of popular music historically and commercially linked with social dancing. When lumped together and regarded nontechnically, these styles are characterized by melodies shaped to standard lengths, syncopated and often complex rhythms, eclectic harmony and instrumentation, and standards of execution that range from inept formula to inventive virtuosity. As viewed by the devotee, jazz is a unique Afro-American music whose freshness and expressiveness are indebted to a free use of the human voice and the fullest possible exploitation of instrumental resources, plus an emphasis upon improvisation. Jazz, to the historian, is a musical compound whose initial synthesis is considered to have taken place under Negro and/or white auspices in the United States during World War I or thereabouts, but whose constituent elements can be traced to the Negro and Creole music of New Orleans as far back as the turn of the century and beyond to ever more remote and speculative origins in Latin America, Europe, and West Africa.

For the initiated, jazz cannot be wholly transferred to music paper. The true idiom is more a matter of how the material is rendered than what it may superficially look like, whether march, stomp, blues, popular song, or, if translatable into the jazz manner, an importation from the classical repertory. Good jazz musicians share a highly developed rhythmic sense anchored to the fundamental beat, considerable powers of improvisation, ample technique, and a group spirit marked by freedom and spontaneity, together with as relaxed an approach as is consistent with energized, intuitive, and hair-trigger responsiveness. It is, therefore, performance, as distinguished from composition or even elaborate arrangement, that often creates, upon the spot, the real jazz.

Etymology.—The etymology of the word is uncertain at best, yet what may well have been

the original climate of jazz music is suggested by such a proposed source as the French verb, *jaser*, which literally means to chat, to chatter, and presumably, by extension, to gossip (in tones). Early spellings in actual use were *jas*, *jass*, and *jaz*. Lafcadio Hearn reported that he encountered one form or another of the term in the Creole patois of New Orleans as far back as 1880. He said that the Louisiana Creoles had it from the Negroes and that it meant "to speed things up" as applied to music of a syncopated nature. Less polite meanings also have been suggested.

Ragtime.—One of the two immediate ancestors of jazz was ragtime, which, in turn, drew upon the march and such minstrel show sources as the buck and wing, cakewalk, and jig. The majority of rags had no text and were more instrumental than vocal in character. The basic rhythmic patterns of ragtime were Negroid and may be divided into two principal types known as primary and secondary rag. A common type of primary rag places a short note in what is normally a position of stress in the measure, a longer note in what is normally an unstressed position. This is a typical device of syncopation, which is essentially a deliberate shifting or displacement of normal metrical accent. Primary rag likewise suppresses accents proper to the established rhythmic pulse and by various means anticipates and postpones them. Secondary rag goes farther, in that it creates two independent rhythm patterns, whereby the melody may be in triple time, while the accompaniment remains in double time. Extended over several measures, secondary rag is often considered to exceed the limits of simple syncopation and becomes what is termed polyrhythm. (Consult Winthrop Sargeant's *Jazz: Hot and Hybrid* for a detailed analysis of jazz polyrhythm.)

Blues.—The second immediate ancestor of jazz was the blues, a type of vocal music now thought to have been developed by the southern Negro from the "cry" and "holler" in the first instance, with later influences from the work song (ensemble) and the spiritual (harmony). The blues took its character not only from a predominantly melancholy emotional content but also from the so-called blue (slightly flatted) notes characteristic of its melodies when sung by ear. These flatted notes, falling particularly on the third and seventh degrees of the scale, gave an unstable intonation to the normally major or minor pitch of these intervals. Unlike ragtime, the blues usually had a text, the bittersweet nature of which dictated a more or less declamatory style of rendering, less staccato rhythm, and a tempo frequently slower (New Orleans and St. Louis blues) than that of ragtime. The blues also made use of barbershop harmonies (highly chromatic chordal progressions) and an additional feature that later became prominent in jazz—the break. The break is a brief, improvised instrumental cadenza containing much syncopation.

Jazz emerged as a synthesis of certain elements of ragtime and the blues. It retained ragtime's rhythmic patterns, particularly secondary rag, while from the blues it acquired melodic resources (particularly "blue" tonality) which were wanting in ragtime. From the blues jazz likewise assimilated the expressive possibilities of a moderate tempo (slow blues) and the potential for freedom and variety afforded by the break.

Hot Jazz.—Early jazz tended to be "hot"

jazz, a relatively unrestrained, largely improvised style (except for basic chordal progression) which, although based upon popular tunes, was played with little or no dependence upon written parts. An early jazz band, which might consist of cornet or trumpet, trombone, clarinet, guitar or banjo, tuba or string bass, piano (if not a wagon band), and drums, would select a tune, perhaps announce it once in order to establish a point of departure, and then proceed to develop it freely under the inspiration of the moment. The development was of at least two kinds: a free-for-all in which each instrument went its own way in melodic and rhythmic competition with the others (New Orleans style); a take-your-turn scheme by which most of the instruments took solos in rotation, the others supplying a supportive background for them (Chicago style).

Sweet Jazz.—A more or less commercialized reaction to "hot" jazz started with the appearance of "sweet" jazz. This type sacrificed spontaneity and power and individual freedom in favor of milder, more conventional appeals. Where the "hot" band played without written parts, the "sweet" band often employed a full score, the players adhering to their parts as written. Suavity, close coordination, and considerable prettiness resulted. The "sweet" band also introduced a number of mild instruments, such as the harp, chimes, and celeste, meanwhile sharing with "hot" bands the violin (quite often to be found in pioneering, "hot" aggregations) and the subsequently adopted saxophone. Certain "sweet" bands, although maintaining among their personnel a nucleus of "hot" players, were ultimately expanded to a point where they approached the small symphony orchestra in numbers and pre-calculated discipline ("symphonic" jazz).

"Sweet" jazz meanwhile adopted the portamento style characteristic of spontaneous vocal blues and exaggerated it into the well-nigh perpetually sliding manner of the early crooner. "Sweet" jazz likewise reached out to various non-Negroid features of contemporary music: for example, melodic material of the sentimental ballad or Viennese light opera species and harmonic devices adapted from 19th century romanticism and 20th century impressionism. The essential jazz idiom was thus carried so far afield that it threatened to remain jazz only by virtue of the fact that it preserved the duple time (4/4) of the fox trot which, during World War I, superseded the one-step and the two-step. At no time, however, did the jazz tradition, even at its widest and loosest, embrace the triple time (3/4) of the waltz, although it did assimilate, during their periods of popular favor, such Afro-American dances as the shimmy and Charleston, such Latin-American dances as the tango, rumba, conga, samba, and mambo.

Swing and Boogiewoogie.—Jazz was refreshed in the mid-1930's by the rise of swing. While none too precise a term, swing may be described as a renaissance of "hot" jazz plus an added measure of premeditation, virtuosity, and, in some instances, slickness. A byproduct of this return to the past was boogiewoogie, heard at private gatherings (Negro) more than a decade prior to its public appearance about 1935-1936. Boogiewoogie is a type of piano blues that consists of a fixed, eight-beat, rhythmic figure for the left hand, above which the right hand improvises freely.

Bebop and Cool Jazz.—The 1940's witnessed the emergence of bebop or "bop," upon which several critics elected to look askance, finding it no more than overstrained "hot" jazz whose accompanying lyrics stressed the bawdy and the nonsensical. But other analysts arrived at far different conclusions, claiming to find in bebop a coolness, lightness, softness, and, despite its leaning toward the use of short phrases, a contrapuntal elaboration, which were a welcome change from what they regarded as the heat, weight, noise, and harmonic rigidity of crystallized swing.

"Cool" jazz, with its concern for a "lag-along" beat and pure instrumental tone and its reconsideration of the working relationship between naive heat and a restrained sophisticated intensity, came to prominence as a successor to bebop from about 1948 onward.

Rock 'n' Roll and Calypso.—A species of strongly rhythmic blues, developed at the outset by Negro musicians for the Negro market in the 1920's and revived in the 1940's, was eventually taken up by white bands, which modified it and popularized it during the mid-1950's under the name of rock 'n' roll. The same decade also proved hospitable to calypso, an importation from Trinidad. A hybrid form, it is said to have emerged under the influence of the West African song of ridicule. Its elements include melodic-harmonic borrowings from the French folk song, texts in a polyglot vocabulary, and African rhythmic infusions. American adaptations often feature lyrics that have lost their satirical bite and rhythms that have lost their indigenous interest.

History.—The history of ragtime is not too well documented, yet there are a few landmarks of tolerable accuracy. Making its appearance near the close of the 19th century with such an early example as *Harlem Rag* (1897) by the pianist Thomas M. Turpin and *Maple Leaf Rag* (1899) by W. Scott Joplin, ragtime was featured by the pioneering band of Buddy "King" Bolden at New Orleans from about 1895 onward, and by the pianist Ben R. Harney, who began a series of New York appearances at Tony Pastor's Variety Theatre in 1896. The first New York stage presentation of ragtime is said to have taken place at Proctor's Theatre in 1905, when Will Marion Cook's *Memphis Students* played a number of rags. *Alexander's Rag Time Band* by Irving Berlin, who did much to popularize ragtime, was published in 1911.

The recorded history of the blues is introduced by the now famous *Memphis Blues* composed by the cornetist and band leader, William Christopher Handy, and published in 1912, although written three years earlier. His equally well-known *St. Louis Blues* dates from 1914. At the outset intended to be sung, the blues had a great exponent in Bessie Smith and remained essentially vocal until the advent of exclusively instrumental blues, such as Edward "Duke" Ellington's *Blue Light*, and boogiewoogie (Jimmy Yancey, "Pine Top" Smith, Thomas "Fats" Waller).

Although the word jazz as applied to a species of popular music is considered to have entered the language (oral) circa 1914-1916 in Chicago, at least partial anticipations of the musical style thus labeled have been traced to examples that pre-date World War I. These anticipations of the "hot" jazz manner are

credited to such precursors as Freddie Keppard and the Original Creoles, reported by "Jelly Roll" Morton to have been playing powerful jazz in New Orleans well before 1914 (1908); Joseph "King" Oliver, cornetist, bandleader, and New Orleans contemporary of Keppard; and Ferdinand "Jelly Roll" Morton himself, composer of *King Porter Stomp* (1906), and arranger of *Tiger Rag*, based on a French quadrille and performed in various "hot" versions under various titles long before it was first recorded in 1917 as *Tiger Rag*. From about 1912 onward, jazz began to fan out from its reputedly original locus in New Orleans (Storyville). Not necessarily in strict chronological order (claims to priority remain in dispute), it is said to have been carried to Chicago by, among others, Tom Brown's Band from Dixieland; to New York by the same band and also by the Original Dixieland Jass (*sic*) Band; to Los Angeles (Keppard and the Original Creoles) and to San Francisco, where Art Hickman introduced a sweetened variety at the St. Francis Hotel as early as 1914.

"Sweet" jazz and "symphonic" jazz received stimulus from Paul Whiteman, who is credited with the first playing of jazz from fully scored parts at Los Angeles in 1920. Whiteman's pianist and arranger, Ferde Grofé, became widely known for his scoring of jazz music through which it reached semisymphonic proportions. Whiteman toured the United States and Europe, particularly during the 1920's, establishing landmarks by his jazz concerts, first in Aeolian Hall, then in the much larger Carnegie Hall, New York City. The Aeolian performance, which occurred on Feb. 12, 1924 and was attended by the first-string music critics of the metropolitan newspapers, purported to be the first jazz concert ever given. The program was highlighted by the debut performance of George Gershwin's *Rhapsody in Blue* (1924), an impressionistic work for piano and orchestra employing jazz elements.

Continuing his interest in jazz, Gershwin followed the *Rhapsody in Blue* with the *Concerto in F Major* (1926) for piano and orchestra; the tone poem *An American in Paris* (1928); *Second Rhapsody* (1932; originally *Rhapsody in Rivets*); a Negro folk opera, *Porgy and Bess* (1935), which was revived for a long run on Broadway in 1942; and *Jazz Piano Preludes* (1936), later scored for orchestra. By means of what was considered their freshness and originality, these works made Gershwin the first prominent example of simultaneous recognition in both tin-pan alley and the concert room.

Although preoccupation on the part of serious composers with jazz music and jazz performers may be said to have reached a peak in America and Europe about the mid-1920's, ragtime and jazz influences can be found in their output as far back as 1908, the publication year of *The Golliwog's Cake Walk* from *The Children's Hour* by Claude Debussy. Three additional early contributions were made by Igor Feodorovich Stravinsky with his *Ragtime* for 11 instruments (1918), *The Soldier's Tale* (1918) and *Piano Rag-Music* (1919).

Apart from Gershwin and by way of supplement to the above-mentioned contributions to at least nominal jazz music by Stravinsky and Debussy, the following representative list of European and United States composers and their compositions which employ ragtime and jazz

will serve to indicate the extent to which these musical forms invaded the art music of the 20th century.

John Alden Carpenter, *Concertino* (1915) for piano and orchestra, featuring ragtime; also his ballet *Krazy Kat* (1922), containing sections labeled "Fox-Trot" and "Blues"; likewise his ballet *Skyscrapers* (1926), using fox-trot rhythms and blues melodies.

Erik Satie, *Parade* (1917), a ballet written for the Russian impresario Sergei Diaghilev and carrying the subtitle *Rag-time du paquebot*.

Darius Milhaud, *Le boeuf sur le toit* (1919), ballet with jazz rhythms; and his *La création du monde* (1923), a ballet based on a scenario by Blaise Cendrars, treating the creation of the world, according to African Negro legends, and including a fugue on a jazz subject, a blues section, and an extended melodic passage with a barber-shop harmonic accompaniment.

Paul Hindemith, *Suite for Piano* (1922) with movements designated "Shimmy" and "Ragtime."

Louis Gruenberg, *The Daniel Jazz* (1924), scored for small ensemble and solo voice, text by the poet Vachel Lindsay.

Arthur Honegger, *Concertino* (1925) for piano and orchestra, with jazz rhythms.

Aaron Copland, *Concerto* (1926) for piano and orchestra, which employs Charleston rhythms and special jazz mutes for trombone.

Ernst Krenek, *Jonny spielt auf* (1927), an opera with a Negro bandleader as hero and, with sections marked "Shimmy," "Blues," and "Spiritual."

Maurice Ravel, *Sonata* (1927) for violin and piano, of which the second movement is a blues.

Constant Lambert, *Rio Grande* (1929), a composition for voices and orchestra, containing jazz rhythms.

Morton Gould, *Chorale and Fugue in Jazz* (1936).

Serious composers have been attracted to jazz by its rhythmic possibilities, by the uncommon tonal qualities to be had from special jazz handling of familiar instruments, and, above all, by the spirit of freedom and crisp candor rarely absent from genuine "hot" jazz and its performers. Composers have presumably been less interested in the emotional gamut of jazz, because it is thought to generate only a few fundamental moods—the melancholy protest or resignation of the blues, for example, and the headlong exhilaration of "jump." The commercial moonlight and roses of such songs as *My Blue Heaven* or *I'll Buy That Dream* stem from the sentimental ballad (as in songs by such composers as Jerome David Kern and Sigmund Romberg) rather than from jazz.

The interest of tin-pan alley commercialism in classical music has likewise been conspicuous and persistent. Early borrowings—such as a theme from Frédéric Chopin's *Fantasia-Impromptu* as the melodic basis of *I'm Always Chasing Rainbows*, and the considerable thematic assistance rendered to *Yes, We Have No Bananas* by the "Hallelujah Chorus" in George Frederic Handel's oratorio, *Messiah*—sired a numerous progeny. Various classics have from time to time been swung, prominent examples including a theme from a Mozart piano sonata which was turned into a fox trot and renamed *In An Eighteenth Century Drawing Room*; also Ignace Jan Paderewski's *Menuet à l'antique*; and Franz Liszt's *Liebestraum*. Other standard instrumental works have been treated more radically, emerging from the tune factory as popular songs. Among these may be cited the transformation of the opening theme of a Peter Ilich Tchaikovsky piano concerto into *Tonight We Love* and the yet more drastic metamorphosis of one of Chopin's polonaises into the sentimental ballad ("sweet" jazz type) *Till the End of Time*.

The evolution of more or less pure jazz, as distinguished from numerous hybrid forms, has acquired momentum from the playing and recordings of carefully selected, highly expert although

relatively large, combinations led by jazz musicians of the caliber of Louis "Satchmo" Armstrong, Fletcher Henderson, Edward "Duke" Ellington, Benny Goodman, William "Count" Basie, Gene Krupa, Woody Herman, Dizzy Gillespie, Stan Kenton, and Lennie Tristano—to name a representative few. Their leadership has proved significant, in that it has consistently affirmed the importance to any art of imagination, innovation, a high order of technical skill, and a following. The best jazz has also helped to keep alive the practice of improvisation, a musical capacity that had reached high levels by Ludwig van Beethoven's time (1770–1827), but suffered a decline in Western music thereafter, until a fresh impetus was supplied by that unassuming pioneer, the Negro folk musician.

That jazz will one day emerge as *the* American music remains a subject of perennial debate. Proponents urge its unremitting search for freshness, depth, and mastery. Opponents cannot forget its dubious origins, its uncommon susceptibility to box office, its comparatively narrow range of intellectual and emotional expression. Meanwhile, however, neither side denies to honest and gifted jazz music a continuing place alike among the enthusiasms of the specialist and in the favor of a large public.

Bibliography.—Whiteman, Paul, and McBride, Mary Margaret, *Jazz* (New York 1926); Armstrong, Louis, *Swing That Music* (New York 1936); Panassié, Hugues, *Hot Jazz* (New York 1936); Goodman, Benny, and Kolodin, Irving, *The Kingdom of Swing* (Harrisburg 1939); Hobson, Wilder, *American Jazz Music* (New York 1939); Ramsey, Frederic, and Smith, Charles E., *Jazzmen* (New York 1939); Copland, Aaron, *Our New Music* (New York 1941); Handy, William Christopher, *Father of the Blues; An Autobiography* (New York 1941); Howard, John Tasker, *This Modern Music* (New York 1942); Panassié, Hugues, *The Real Jazz* (New York 1942); Sargeant, Winthrop, *Jazz: Hot and Hybrid* (New York 1946); Delaunay, Charles, *New Hot Discography: The Standard Directory of Recorded Jazz* (New York 1948); Ulanov, Barry, *A History of Jazz in America* (New York 1952); Stearns, Marshall, *The Story of Jazz* (New York 1956).

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JEAFFRESON, jěf'ěr-s'n, **John Cordy**, English author: b. Framlingham, Suffolk, England, Jan. 14, 1831; d. London, Feb. 2, 1901. He was graduated from Oxford University in 1852 and then taught in private schools for six years. After 1858 he was a regular contributor to the *Athenaeum*. His first novel *Crewe Rise* (1854) was followed by a lengthy series in the three-volume type then popular, among them *Live it Down* (1863) and *Not Dead Yet* (1864), which were moderately successful. He was appointed inspector of documents for the Historical Manuscript Commission in 1874. He wrote five popular works of two volumes each, of anecdotal social history: *A Book about Doctors* (1860); *A Book about Lawyers* (1866); *A Book about the Clergy* (1870); *Brides and Bridals* (1872); *A Book about the Table* (1874). His duties as inspector of documents gave him access to manuscript collections which resulted in his publication of *The Real Lord Byron* (2 vols., 1883); *The Real Shelley* (2 vols., 1885); *Lady Hamilton and Lord Nelson* (2 vols., 1888); *The Queen of Naples and Lord Nelson* (2 vols., 1889; new ed., 1897).

JEALOUSY, jě'l'ūs-i, a complex and relatively enduring affective reaction, or emotional attitude, based upon a feeling of insecurity and

directed toward another person. Verbal reports by jealous adults usually mention the presence of anger, despair, and self-pity as the main components. The amount of jealousy may vary from a mild envy to obsessive thoughts of vengeance. A pervasive sense of inferiority and anxiety may lead one to become envious of the recognition and acceptance which others seem to receive from their associates. Hence, jealous feelings may arise and a state of melancholia ensue.

René Descartes (1596–1650), the French philosopher and scientist, regarded the state of jealousy as one of the six unlearned emotions. Contemporary psychologists regard it as a hybrid learned reaction which has its roots in the basal anxiety about being rejected, unloved, and unwanted. Those situations which excite the basal anxiety may be real or imaginary. The causes may exist only in the disordered fantasies of the jealous person. An unscrupulous person may suggest that there are causes for jealousy, as in the case of Iago, who implanted jealous thoughts in the mind of Othello in the Shakespearean play.

Jealousy has been reported in children as young as two years of age. The cause for such reactions is usually the arrival of a new brother or sister. Lack of thought about preparing the older child for acceptance of a new member of the family circle, favoritism, rejection of the older, or a lack of emotional security in the home are often mentioned as causes for what is termed sibling rivalry. Temper tantrums, regression in food habits and toilet functions, and excessive demands upon the parents may indicate that the older child is jealous. The treatment involves, in some instances, psychotherapy with the parents of the small child who is jealous.

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JEAN BAPTISTE DE LA SALLE, zhān bà-tēs't' dē là sāl', SAINT, French priest and educator: b. Reims, France, April 30, 1651; d. Saint-Yon near Rouen, April 7, 1719. He was tonsured at the age of 11 and was made a canon of Reims in 1667. He studied at the University of Reims (where he was later—in 1681—admitted to the doctorate in theology) and subsequently at the Sorbonne while residing at the Seminary of St. Sulpice in Paris. He received priest's orders in 1678. After his return to Reims he met in 1679 a layman, Adrien Nyel, who interested him in a project of schools for poor boys. La Salle's zeal for this work had so grown by 1681 that he invited the seven masters who taught them to live in his own house.

From this beginning gradually emerged the idea of a religious institute; and La Salle resigned his canonry (1683) and disposed of his property by giving it to the poor in order to devote himself entirely to education. Four schools were now being conducted by his men and, after a conference with 12 of them, it was decided in 1680 that they would band together as Brothers of the Christian Schools (q.v.). The first recruits had been full-grown men; but in 1685 it became necessary to organize a junior novitiate to accommodate boys between 15 and 20, who began to apply in large numbers. La Salle also established training schools for lay teachers (Reims, 1687; Paris, 1699; Saint-Denis, 1709).

A characteristic feature of La Salle's educational system was his insistence on the use of

the vernacular instead of Latin. He also brought into practice "simultaneous" or class, as opposed to individual, instruction; and he preferred the Socratic to the lecture method. After some initial opposition, his ideas gradually won the approval of the universities as well as of ecclesiastical and civil authority.

One of La Salle's most interesting foundations was that of the Écoles Dominicales in 1699 at Paris, where regular public courses in arts and sciences were given to all comers on Sundays. In 1688 he had assumed control of the parish school at St.-Sulpice in Paris, the last of the seven free schools founded by his famous predecessor, Père Jean Jacques Olier (1608–1657, q.v.). A second school was opened, and both were placed under Frère Henri L'Heureux, whom La Salle had selected as his successor and whom he was about to present for ordination. The unexpected death (1690) of this man seems to have given check to La Salle, causing him to establish the statute that none of his community could be a priest and that no priest could be received as a full member into the Institute of the Brothers of the Christian Schools. He thus assured the absence of any caste system in it.

La Salle opened a school in 1698 for 50 boys of gentle birth at the request of the exiled King James II of Great Britain. Frère Gabriel Drolin was sent in 1700 to found a school in Rome; and many others were established in France prior to La Salle's resignation as superior in 1717. Henceforth he lived in the Novitiate at Saint-Yon, where he taught and wrote, while following the routine imposed on the humblest of his brethren until his death.

La Salle was of striking and dignified appearance; well connected, refined, and scholarly. He was gentle and kind in his dealings with others. In his spiritual outlook and doctrine he was an exponent of the attractive humanistic spirituality of the French school headed by Pierre Cardinal de Bérulle (1575–1629) and Père Olier. His published writings are concerned with both educational and ascetical subjects. His works include *Les devoirs du chrétien* (1703) and *Conduite des écoles* (1717).

The constitutions of the institute which La Salle had drawn up about 1695 were finally approved in 1725 by Pope Benedict XIII. La Salle was canonized in 1900 by Pope Leo XIII. Pope Pius XII declared him the patron of all school-teachers in 1950. His institute has grown to be the largest teaching order in the Roman Catholic Church. His feast is on May 15.

Consult Battersby, William J., *De La Salle: A Pioneer of Modern Education* (London 1949); id., *De La Salle: Saint and Spiritual Writer* (London 1950); id., *St. John Baptist de la Salle* (New York 1957).

ALASTAIR GUINAN.

JEAN CHRISTOPHE, zhān krēs-tôf', by Romain Rolland. One of the most noteworthy novels to appear in France from Émile Zola's death (1902) to the opening of World War I (1914) was the *Jean Christophe* of Romain Rolland. Its importance lies partly in the novelty of its informal manner and partly in the range and importance of its theme. With regard to manner, Rolland has discarded rhetoric and eloquence, climax, dramatic effect, and all the novelist's traditional methods to tell his story in the simple language of conversation and to follow in his meandering and now and then clogged and almost tedious

narrative, the slow moving processes of life. With regard to his theme, he had set himself the task of studying the unfolding of a musical genius, tracing him from infancy through childhood and adolescence in Germany, to full maturity in Paris, at a time of unsettled, shifting, and conflicting ideals. This gradual unfolding of the temperament of Jean Christophe provides the principle of unity which links the 10 small volumes of the French edition. But the analysis of Jean Christophe's psychology is but one element of interest; for the larger aspects of the theme imposed themselves upon the author as he proceeded and as he brings his hero into contact with the ruling classes in Germany, with new-found French friends and with the world of music and letters. His minute study of a single great man thus widens, until it becomes a dispassionate yet keen survey of the national ideals of leading European peoples in the somber twilight that marked the closing of the 19th century. Teacher and critic rather than great creative artist, Rolland had been moved to write the history of the inner life of the generation that came to maturity before World War I and to present its account to posterity.

The task was a large one and the results were uneven. The earlier volumes, especially the first, dealing with the childhood of Jean Christophe in the old-fashioned south German town, have the clearness, quaintness and charm of old engravings and are artistically the most perfect. As he proceeds and his subject broadens, the author loses himself in disquisitions on art and politics, but especially on music, which even when correct in substance are out of focus. The later volumes therefore give an impression of diffuseness and lack of artistic mastery and are marked by the touch of resentment of one who had struggled long and bitterly for recognition. No author of the time, however, had shown greater penetration, and the contrast between Teuton and Latin character and civilizations was clearly and truthfully drawn. Rolland knew the hidden springs from which France drew her strength and was conscious of the coming "revival" of the spirit of France. He foresaw also the rapidly approaching era of force and war, and his later volumes read like a prophecy of the coming cataclysm which he deplored. This is a testimony to the truth of his diagnosis. When, however, after the outbreak of the war he pleaded in *Above the Conflict*, as he had done in his novel, for mutual understanding, he was disowned by the generation which had earlier acclaimed him as its spokesman.

When all is said, in spite of the touches of sourness, of inconsistencies, tiresome disquisitions, and occasionally grotesque psychology, Rolland's scope and range, his earnestness, sincerity and vision mark his work as one of the truly important achievements in French prose fiction of the early 20th century.

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JEAN DE MEUNG, zhān' dě mūn' (real name JEAN or JEHAN CLOPINEL or CHOPINEL), French poet: b. Meung-sur-Loire, France, ?1240; d. ?1305. According to tradition, he studied at the University of Paris. His literary fame rests on his authorship of the greater part of the *Roman de la Rose* (q.v.), the most famous French poem of the 13th century, of which

Geoffrey Chaucer was to make good use in *The Canterbury Tales*. The first part of the *Roman* consisting of 4,669 lines was the work of Guillaume de Lorris who died some time before 1240. Internal evidence indicates that the additional 18,000 lines were composed by Jean de Meung some time between 1268 and 1285. It is by far the more important section of the poem. In theme and spirit the two authors are in striking contrast: de Lorris began the work as an allegory to teach the art of love to courtiers and their ladies; de Meung, with an immense scientific and literary learning, continued it as a satire on the social system of his day, his shafts striking all the vested interests with perfect impartiality. The poem entitles Jean de Meung to rank as the greatest of French medieval poets; its skeptical, mocking spirit is echoed down the centuries in the writings of prose writers as well as poets. Other works of de Meung include a translation of the *De re militari* of Vegetius, appearing as *Le Livre de Vegèce de l'art de chevalerie* (1284); the first French version of the letters of Abelard and Héloïse; a translation of Boethius' *De consolatione philosophiae*. Toward the end of his life appeared his *Testament* in which, while praising sincere piety, he poured his scorn on the monastic orders.

Consult: Paris, Paulin, "Jean de Meung," vol. 28 in *Histoire littéraire de la France* (Paris 1840); Langlois, C. V., introduction to his 1914 ed. of *Roman de la Rose*.

JEAN PAUL. See RICHTER, JEAN PAUL FRIEDRICH.

JEANERETTE, jĕn-ĕr-ĕt', town, Louisiana, in Iberia Parish, 32 miles east of Lafayette, situated on the Bayou Teche, and served by the Missouri Pacific and Southern Pacific railroads and state highways. Located in a rich agricultural section producing pecans, rice, and sugar cane, it has six sugar refineries, a cane cutter factory, and a boiler works. Other manufactures include agricultural machinery, boats, wood and machine shop products, and mattresses. The town has a library and a municipal airport. Nearby is a federal livestock experimental station. Pop. 5,568.

JEANES, jĕnz, **Anna T.**, American Quaker philanthropist: b. Philadelphia, April 7, 1822; d. Germantown, Pa., Sept. 24, 1907. She was deeply interested in charitable and educational institutions and gave freely to their support, as well as to projects for the elevation of the Negro race in the United States. By her will she disposed of her estate, worth over \$5,000,000, among 30 charitable institutions, also giving \$200,000 to the Friends Boarding Home, Germantown, Pa., to which she retired in her last years. She also gave \$1,000,000 as a "Fund for Rudimentary Schools for Southern Negroes," known as the Anna T. Jeanes Foundation (q.v.).

JEANES (Anna T.) FOUNDATION, a fund of \$1,000,000 placed under the trusteeship of Booker T. Washington and Hollis B. Friswell, April 1907, by Anna T. Jeanes, for the purpose of "assisting in the southern United States community, country and rural schools for the great class of Negroes to whom the small rural and community schools are alone available." The work of the foundation is closely allied with that of the General Edu-

cation Board. It concerns itself chiefly with industrial education, extension work, and the improvement of educational and home conditions.

JEANNE D'ARC. See JOAN OF ARC.

JEANNETTE, jě-nět', city, Pennsylvania, in Westmoreland County, located 22 miles east-southeast of Pittsburgh. Jeannette is in an agricultural and coal mining region, and has plentiful natural gas. The city has several industries. Manufactures include window glass and pressed glassware of many varieties, rubber tires and tubes, turbines, condensers, and electrical equipment. Settled in 1888 and incorporated in 1889, Jeannette is called the "Glass City" from having grown up around glass works founded in 1889 by a group including H. Sellers McKee, for whose wife it was named. Pop. 16,565.

JEANNETTE EXPEDITION, an enterprise projected in 1879 by James Gordon Bennett, Jr., of the New York *Herald*, who sent out an Arctic expedition for exploration by way of the Bering Strait in the *Jeannette*, under the command of George Washington De Long, United States Navy. Sailing from San Francisco, Calif., the *Jeannette* was early caught in the ice pack, drifted for nearly two years, and never escaped from its grip. After the *Jeannette* sank on June 13, 1881, the crew attempted to reach Siberia in three open boats. One boat disappeared, and that of chief engineer George Wallace Melville reached an eastern mouth of the River Lena; De Long, with 14 companions, reached the main mouth of the Lena but died shortly afterward from exposure. Melville recovered his body and brought it to New York City, which he reached in May 1882. In June 1938 a Russian party found De Long's indecipherable diary in an improperly sealed copper cylinder on Henrietta Island, which the explorer had named.

Consult Ellsberg, E., *Hell on Ice* (New York 1938); De Long, E. W., *Explorer's Wife* (New York 1939).

JEANS, SIR James Hopwood, English physicist, astronomer, and author: b. London, Sept. 11, 1877; d. Dorking, Surrey, Sept. 16, 1946. He graduated at Trinity College, Cambridge University, with high distinction in mathematics in 1898, and in 1904 was appointed university lecturer in mathematics. From 1905 to 1909 he was professor of applied mathematics at Princeton University, and during 1910-1912 he was Stokes lecturer in applied mathematics at Cambridge. In 1919 he was appointed secretary of the Royal Society, a post he continued to occupy until 1929; he was also professor of astronomy in the Royal Institution during 1924-1929, and again from 1934. From 1923 to 1944 he was research associate of Mount Wilson Observatory, in California. As a physicist, he devoted much attention to the kinetic theory of gases and aspects of radiation; and as an astronomer, he was concerned with mathematical analysis of problems in the field of cosmogony. He propounded theories of the effect of gravitational attraction on stellar motions, and of the nature and formation of binary stars, spiral nebulae, giant and dwarf stars, and gaseous stars. His numerous works, some of them popularizing science, included *A Dynamical Theory of Gases*

(1904); *Theoretical Mechanics* (1906); *The Mathematical Theory of Electricity and Magnetism* (1908); *Radiation and the Quantum-Theory* (1914); *Problems of Cosmogony and Stellar Dynamics* (1919); *Atomicity and Quanta* (1926); *Astronomy and Cosmogony* (1928); *The Universe Around Us* (1929); *The Mysterious Universe* (1930); *The Stars in Their Courses* (1931); *Through Space and Time* (1934); *Science and Music* (1937); *An Introduction to the Kinetic Theory of Gases* (1940); *Physics and Philosophy* (1942).

JEBB, (Hubert Miles) Gladwyn (BARON GLADWYN OF BRAMFIELD), British diplomat: b. Rotherham, Yorkshire, England, April 25, 1900. He studied at Magdalen College, Oxford, and graduated with honors in 1922. Entering the diplomatic service, he served in Teheran (Tehran) and Rome, and at the Foreign Office in London. During the early years of World War II he was attached to the Ministry of Economic Warfare, and in 1942 he returned to the Foreign Office to head its reconstruction department, concerned with postwar problems. In March 1943 he visited Washington, D.C., in company with Foreign Secretary Anthony Eden to discuss prospects for a United Nations organization, and he subsequently went to the Dumbarton Oaks Conference, in Washington, and to the conference at Yalta where President Franklin D. Roosevelt and Winston Churchill met with Marshal Stalin. He was a leading British delegate to the San Francisco Conference in the spring of 1945 when the United Nations Charter was signed, and in August of that year he became executive secretary of the United Nations Preparatory Commission—which worked out detailed plans for the organization. In 1946 he deputized for Foreign Secretary Ernest Bevin at the Paris Conference which evolved the Italian peace treaty, and in 1948, with the personal rank of ambassador, he was British representative on the Brussels Treaty Permanent Commission. Knighted in 1949, he was Britain's permanent representative at the United Nations (1950-1954) and ambassador to France thereafter until 1960, when he was elevated to the peerage.

JEBB, SIR Richard Claverhouse, Scottish Greek scholar: b. Dundee, Aug. 27, 1841; d. Cambridge, Dec. 9, 1905. He was educated at the Charterhouse, London, and at Trinity College, Cambridge University. From 1875 until 1889 he was professor of Greek at the University of Glasgow, and thereafter he occupied a like chair at Cambridge until his death. From 1891 he was also member of Parliament for Cambridge University. In 1874 he married the widow of Gen. Adam J. Slemmer, American army officer, and he paid several visits to the United States. He published translations, with notes, of several of the Greek writers; his greatest work was his edition of Sophocles, which was regarded as the most completely satisfactory commentary on a classical author that had been written in the English language. He was knighted in 1900, and received the Order of Merit in 1905.

JEDBURGH, jěd'bŭ-rŭ, burgh, Scotland, county town of Roxburgh, located on the Jed, a tributary of the Teviot, 56 miles southeast of Edinburgh. Here is a stately ruined abbey founded as a priory for the Augustinian monks in 1118 or 1138 and erected into an abbey by David I in 1147. The

castle, erected by David I and occupied by William the Lion and other Scottish kings, was leveled by the townspeople in 1409 because its frequent capture by the English in border fighting menaced their security. The site was occupied by a prison in 1823, but the building fell into disuse and came to be called "the castle." There remain houses occupied by Mary Queen of Scots in 1566 and by Prince Charles Edward in 1745. The poet James Thomson was educated at a grammar school here, and the town also has associations with Robert Burns and William Wordsworth. In 1955 its principal industries were woolen milling, leather tanning, and the manufacture of artificial silks. Pop. (1961) 3,647.

JEDDAH. See JIDDA.

JEEJEEBHOY, jē-jē-bā'ē, **SIR Jamsetjee**, Indian merchant and philanthropist: b. Bombay, India, July 15, 1783; d. there, April 14, 1859. The son of poor parents, he amassed a fortune of £2,000,000 in the China trade and in other ventures, becoming the foremost merchant in India. He gave away much of his wealth for charitable purposes. In 1822 he secured the release of all persons imprisoned for debt in Bombay, by meeting the claims against them. He also gave large sums for the relief of victims of disastrous fires at Surat in 1824 and 1837; provided funds for the performance of Parsi religious rites; endowed a hospital in Bombay in 1843 and schools in several Indian cities; and financed the construction of valuable public works. He was knighted on May 2, 1842, and was created a baronet of the United Kingdom on Aug. 6, 1857.

JEFFERIES, jěf'riz, **Richard**, English naturalist and author: b. near Swindon, England, Nov. 6, 1848; d. Goring, Aug. 14, 1887. The son of a farmer, he was self-educated except for some years of elementary schooling. At 16 he ran away from home with a friend to go to Russia or America, but was compelled to return by lack of funds. His talents were noticed by the publishers of local newspapers, and he was employed to write descriptive articles and news reports. Meanwhile he began work on several novels and plays, but his first efforts were failures. After 1872, however, he became a regular contributor to leading English magazines. His series of articles "The Gamekeeper at Home," reprinted in 1877 from the *Pall Mall Gazette*,

established him in popular favor; but his health, always precarious, broke in 1881. He continued working as long as he was able and became celebrated for his prose style, acute observation of rural life, and purity of feeling.

Jefferies' late works include several collections of sketches, notably *Wild Life in a Southern County* (1879), *The Life of the Fields* (1884), and *Red Deer* (1884); and several novels, including *Wood Magic* (1881), *Bevis* (1882), *After London* (1885), and *Amaryllis at the Fair* (1887). He was also the author of an autobiography, *The Story of My Heart* (1883).

Consult Arkell, Reginald, *Richard Jefferies and his Countryside* (London 1947).

JEFFERS, jěf'ērz, (**John**) **Robinson**, American poet: b. Pittsburgh, Pa., Jan. 10, 1887; d. Carmel, Calif., Jan. 20, 1962. He graduated from Occidental College in 1905 and was subsequently a student of medicine, forestry, and other subjects at the University of Washington, the University of Southern California, and the University of Zürich, Switzerland. After 1913 he resided in Carmel, Calif., and the adjacent country became the habitual setting of his poems. His principal themes are the grandeur and beauty of nature, the comparative insignificance and worthlessness of modern man, and the consequent good to be found even in negative or destructive forces, such as war. His first volume of poems, *Flagons and Apples* (1912), is considered uncharacteristic. His later works, including several long narrative poems, frequently make use of materials drawn from ancient Greek culture, and are filled with incidents of violence and sexual perversion, symbolic of larger social or cosmic events. Considered characteristic of Jeffers' mature work are *Tamar and Other Poems* (1924); *Roan Stallion* (1925), an allegorical narrative in free verse included in a new edition of the previously named volume; *The Women at Point Sur* (1927), a free verse narrative; *Cawdor and Other Poems* (1928); *Dear Judas and Other Poems* (1929); *Descent to the Dead* (1931); *Thurso's Landing and Other Poems* (1932); *Give Your Heart to the Hawks* (1933); *Solstice and Other Poems* (1935); *The Double Axe* (1948). His free translation of *Medea*, by Euripides, was produced on Broadway in 1947 and later on television.

Consult Powell, Lawrence C., *Robinson Jeffers: The Man and His Work*, rev. ed. (Los Angeles 1940).

Arctic Ocean



East Siberian Sea

Beaufort Sea

Baffin Bay

GREENLAND

USSR
(SIBERIA)

ALASKA

Victoria Island

Devon I.

Thule

Davis Strait

Godthaab

Hudson Bay

CANADA

UNITED STATES

North Atlantic Ocean

North Pacific Ocean

Midway Is.

Wake I.

HAWAII

Ocean

Marshall Islands

Gilbert Islands

EQUATOR

Bismarck Arch.

Solomon Islands

New Hebrides

New Caledonia

Tasman Sea

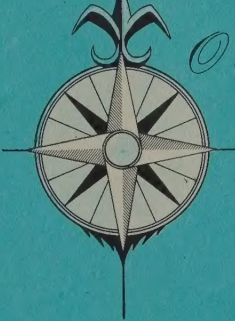
Auckland

Wellington

NEW ZEALAND

South Pacific Ocean

N



Marquesas Is.

Tuamotu Arch.

Pitcairn I.

Galapagos Is.

ECUADOR

PERU

CHILE

ARGENTINA

BOLIVIA

PARAGUAY

URUGUAY

BRASIL

Colombia

Venezuela

Trinidad-Tobago

Surinam

Guiana

Belm

Rio de Janeiro

Sao Paulo

Montevideo

Buenos Aires

Tierra del Fuego

S. Georgia

S. Shetland Is.

S. Orkney Is.

Antarctic Peninsula

Alexander I. Island

Weddell Sea

Bellinghousen Sea

Marie Byrd

Antarctica

Victoria Land

